Traffic Engineering

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COVER: Artist's drawing of a typical interchange design for the New Jersey Turnpike.

Traffic Engineering is that phase of engineering which deals with the planning and geometric design of streets, highways, and abutting lands, and with traffic operation thereon, as their use is related to the safe, convenient, and economic transportation of persons and goods.

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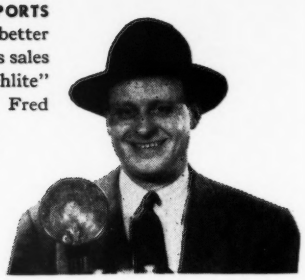

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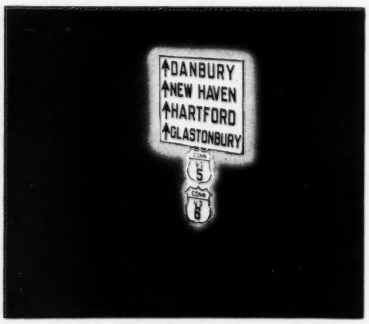

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LETTERS TO THE EDITORS

Traffic-Actuated Signals

In the December issue of "Traffic Engineering" magazine there is an article entitled *Traffic-Actuated Signals Had Premier in Baltimore,* which stated, among other things, that the first installation of electromatic signals was made in New Haven on April 10, 1928, some time after the Baltimore installation. This was a surprise to me since I had always understood that the installation of actuated signal equipment at the corner of Orange and Humphrey Streets in New Haven was the first in the world.

I have checked this matter thoroughly and would like to state the facts as I have found them. According to the official records of the New Haven Police Department, the electromatic equipment was installed and successfully demonstrated in full operation at the corner of Orange and Humphrey Streets on November 2, 1927. These facts are also reported in the "New Haven Register" of the same date.

It appears, therefore, that New Haven retains the credit for the first traffic actuated signals, along with the first telephone exchange and many other inventions.

EDMUND R. RICKER
Traffic Engineer
City of New Haven
New Haven, Connecticut

Reference Notes

This particular matter happens to occupy my attention at the moment in view of my present work on the new "Traffic Engineering Handbook" so I am *sharp* on the subject. The signal head on page 166 of the January issue is of non-standard design, since the new Manual of Uniform Traffic Control Devices states, under Section 272, that a "walk" signal shall always be accompanied by a "wait" or "don't walk" indication. I think it would be well to conform with standard design insofar as possible in connection with illustrations in the magazine.

HENRY K. EVANS
Hwy. Transp. Specialist
Chamber of Commerce of the
United States
Washington, D. C.

I would like to report that the heads shown are of a vintage a number of years old and it was not my intention to illustrate them as a desired standard for walk indications.

At the time these heads were installed they conformed to the State of Illinois Manual, which, by the way, is now in process of being revised. We are recommending that "walk-wait" indications be specified in our new Manual as in the Manual on Uniform Traffic Control Devices for Streets and Highways issued by the Bureau of Public Roads.

VICTOR G. HOFER
Traffic Engineer
Chicago Park District
Chicago, Illinois

Lane Marking

In reference to Mr. Chaffee's article entitled *An Investigation of Lane Markings on a One-Way Street,* appearing in the December 1949 issue of "Traffic Engineering" magazine, I would like to know how the traffic distribution varied some time, say six months and one year, after the lane markings were put down, assuming they were maintained in good condition. In other words, did your drivers become used to, and subsequently ignore the laning marks, or did they progressively improve their driving as they realized the usefulness of the marks?

NORMAN RICHARD
50 Eden Park Avenue
Beckenham, Kent, England

● We contacted the City Traffic Engineer in New Haven, Connecticut, and ascertained that the lane markings were not maintained; therefore, providing no opportunity for further study. The Traffic Engineer stated that the markings were put down solely for Mr. Chaffee's thesis study.—ED.

City Traffic Administration

Congratulations to Mr. J. A. Carrothers, Traffic Engineer of the City of Schenectady, for his very fine article entitled *City Traffic Administration* in the January 1950 issue of "Traffic Engineering" magazine. This article truly rings the bell as to why our present traffic congestion and poor accident experience are still with us.

It has been my experience that it is primarily not a lack of money, a lack of police manpower or a lack of educational facilities, but merely a matter of convincing the powers to be that something should be done to correct the hazardous situation. Once having convinced the proper individual, or individuals, ways and means are generally found within a reasonably short period of time which either provide a considerable measure of relief or even a complete solution to the problem.

Here's hoping that this article will open the eyes of at least one individual so that one more traffic problem will be solved.

HERBERT J. KLAR
Assoc. Traffic Engr.
Traffic Control and
Regulation Bureau
Trenton, New Jersey

General

It may interest you to know that I was a member of the Israel Delegation to the U. N. Conference on Road Transport in Geneva (August-September 1949). As far as I could find out, I was the only ITE member there. I very much enjoyed the contact with the colleagues of all the other countries, especially with the gentlemen of the U. S. Delegation, and among them, Mr. Fairbank, Deputy Commissioner of Public Roads.

With the steady increase of motor vehicles of all kinds in our country and the steady influx of thousands of immigrants, traffic conditions are becoming more and more critical, especially in Tel-Aviv's downtown district.

We are trying hard to cope with the situation by a comprehensive system of one-way roads, traffic lights, ban of slow-moving vehicles from the main roads at peak hours, prohibition of loading and unloading, prohibition of left-hand turns, etc.

J. A. FRAENKEL
Chief Traffic Engr.
Department of Road Transport
State of Israel, Tel-Aviv

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R. W. BUYERS
General Manager
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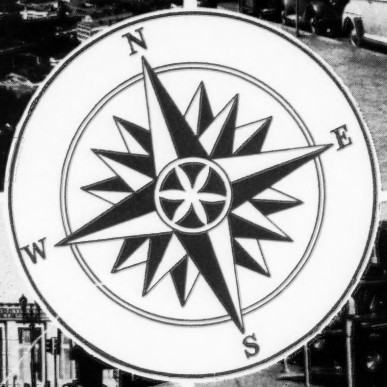

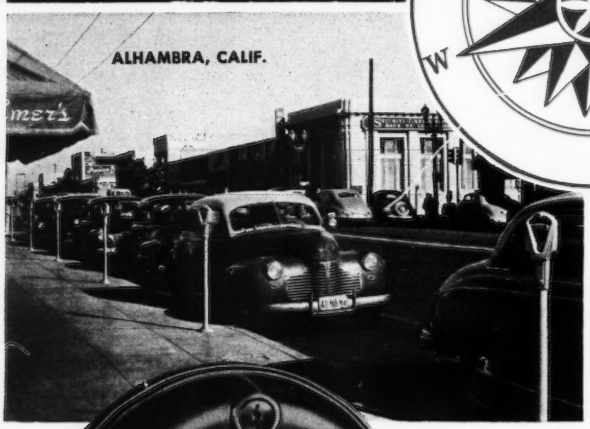

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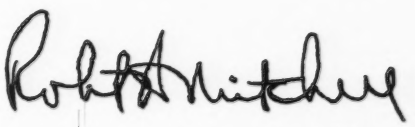
Frankly Speaking

FUNDS for state highways have been spread so thin that it has been impossible to build much needed limited access highways between large centers of population and expressways in the congested business districts of cities.

The report, "Controlled Access Expressways in Urban Areas" by the Highway Research Board, points out that such highways provide the *only* way of obtaining sufficient capacity in areas subject to heavy traffic. It also makes the following very significant statement, "The mileage of the express type highway will constitute only a small percentage of the total road mileage in America. But it is an important mileage. It will carry a significantly large proportion of the traffic in the area it serves. It is the leaven in the dough contributing the difference between meeting the challenge of the automobile age or allowing the automotive revolution to master and overwhelm many mature and declining urban centers."

We are apparently in this situation because the people in the rural areas have always been able to out-vote city dwellers in State Legislatures thus placing too many miles of major roads under the jurisdiction of state highway departments. Yet the city dwellers supply a very high percentage of the funds for these highways.

The Federal Government has finally become aware that something must be done about the lack of major highways in and near centers of urban population. A Congressional Committee is studying the facts and has already determined that approximately 41 billion dollars are needed to do the job. There is probably no technical group more interested in this program than Traffic Engineers and each City or State Traffic Engineer has a solemn obligation to back-up this program with all the knowledge and influence at his command.



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Polarized Light For Auto Headlights

By L. W. Chubb Jr.
Research Department, Polaroid Corporation, Cambridge, Mass.

This is the first of two articles dealing with the evolution of a technically perfected headlighting system which eliminates glare and provides increased visibility. The present article discusses only those fundamentals of polarization which are of particular importance in the headlighting application.

Part I

LIGHT is energy in visible form, traveling from a source where it is generated through space, air or other transparent media. Its existence is detected when it falls upon a receiver which may respond in any of a number of ways, chemically, physically or mechanically. The receiver with which we are most familiar is the human eye, but this organ is capable of responding to only a small portion of the electromagnetic spectrum known as the visible spectrum. However, it is this fragment of the whole range of radiation which contains what we commonly call light and with which we will be concerned here.

The classical theory of the nature of light teaches that it is propagated in the form of sinusoidal waves and that these waves exist in all planes at right angles to and containing the direction of propagation. If we imagine ourselves looking head-on into a beam of light and being able to see this structure, it might appear as a rimless wheel with an infinite number of spokes, wherein each spoke and its diameter continuation represents an edge-view of one of the light waves. (See Fig. 1-A.) The lengths of the spokes represent the amplitudes of the waves (related to brightness) and the center of the wheel, the end view of the axle which represents the direction of travel of the light beam.

What about color? We know that the normal eye can distinguish red light from green, blue from yellow, etc. Our head-on view tells us nothing about color. For a graphical explanation of color, we must imagine ourselves able to see a similarly highly magnified view of a light wave from a direction at right angles to our head-on view; a side view. Here we find that different colors are represented by different wavelengths; that is, differences in the distances between successive peaks of the sinusoidal waves. (Fig. 1-B.) Blue light has shorter wavelengths than yellow, yellow shorter yet than red. If the wavelengths are long or short beyond certain limits, (somewhat variable between individuals), the radiation becomes invisible, i.e. lies outside of the visible spectrum. White light is a mixture of approxmately equal amounts of visible light of all wavelengths.

Light may possess a further characteristic known as polarization. This property can be represented, in our first imaginary view of a light beam, by a vectorial resolution of all of the spokes of the wheel into a single pair of spokes extending in a *single* plane at right angles to and containing the axle. (Fig. 1-C.) This type of polarization is known as plane, or more properly, linear polarization and is the type which will be implied herein when the term polarization is used, although there are other types such as elliptical, and circular. Also, when we speak of polarized light, we will assume light which has not had its color characteristics materially altered by the act of polarizing it.

Let us now consider how light may become polarized. There are four principal ways by which this is accomplished: by scattering of light by small particles such as dust, by reflection from smooth, non-metallic surfaces or by passing it through certain "doubly-refracting" crystals which divide the vibrations into two rays polarized at right angles and which can, by proper cutting, be made to deviate the unwanted vibrations from the direction of propagation. Fourth, there exist a limited number of transparent materials which possess the unique property of transmitting only certain components of ordinary light's symmetrically arranged vibrations, at the same time absorbing the remaining components. We find examples of polarization by each of these methods in nature. Thus the light from a certain part of a deep blue sky is polarized by scattering. Much of the reflected light we see coming from windows, paved roads and shiny table tops is polarized by reflection. Crystals of the doubly-refractive mineral calcite can be made to produce polarized light over narrow apertures by carefully sawing apart and re-joining the pieces in a special way. Certain rare chemical substances, when in crystalline form, will polarize by absorption light

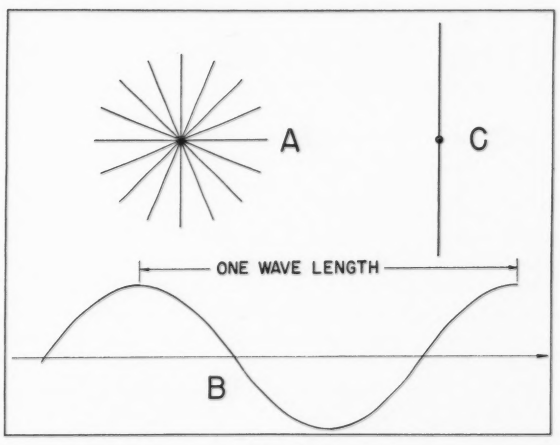


Fig. 1

which is made to pass through them. Examples of this are the semi-precious minerals tourmaline and the comparatively rare substance known as Herapathite, a synthetic salt of quinine.

In examining the application of polarization to auto headlights, we may omit consideration of the methods of polarization by scattering, reflection, and double refraction. None of these methods is adapted to produce polarized light free from an admixture of substantial amounts of unpolarized light, without the use of bulky structures which must be carefully affixed and controlled in position to receive and redirect the light rays at critical angles. In an application of a polarizer to any light source, the type which polarizes by absorption is the most practical and convenient.

For more than a century after the discovery of polarized light, this type of polarizer could be used only where small areas were involved and where bright light sources were available. Neither tourmaline nor Herapathite occurred in single crystals or sufficient size to cover a large light source and tourmaline, which is the more stable and handleable of these substances, was usually deeply colored or even smoky in appearance. It was not until the late 1920's that it became possible, through the invention of Dr. Edwin H. Land,* to produce absorption-type polarizers economically and in unlimited area. Today, several such sheet-polarizers are manufactured and sold by Polaroid Corporation under the trade name "Polaroid". Most of us are familiar with the use of this material in sunglasses, camera filters, desk lamps, etc.

Unlike light having a predominant color characteristic, polarized light cannot be identified as such by the unaided eye or by the other common receivers, but when suitably analyzed, is found to behave differently from ordinary light. It is customary to detect the presence of polarization and to make use of polarized light by employing a second polarizer in addition to the one producing polarization of the light at a source. The second polarizer is termed the analyzer and is usually employed at the eye or other receiver. As its name implies, it analyzes the incident light in such a way as to inform the receiver about its polarization characteristics. This information is obtained from the relationship between the amount of light transmitted by the analyzer and its orientation as it is rotated in its plane at right angles to the light beam. An illustration will help explain the interaction of a pair of polarizers. In the following simple experiments, we shall concern ourselves with what happens rather than why it happens.

If we face an incandescent lamp burning in a dark room and introduce a Polaroid sheet before our eyes, the brightness of the light falling upon our eyes is reduced noticeably. This is because the analyzer (polarizer used at the eye) absorbs all of the components of the light vibrations from the lamp which are not transmitted. These amount to about half of the total and, in fact, it is important to remember that an absorption-type polarizer of maximum efficiency can transmit only up to 50 per cent of ordinary light normally incident upon it. As we rotate the analyzer in its plane, we note no variation in intensity of the light source. For, although polarized light is entering our eyes, they contain no mechanism for detecting it as such.

*President and Director of Research, Polaroid Corporation, who collaborates in the second article of this series.

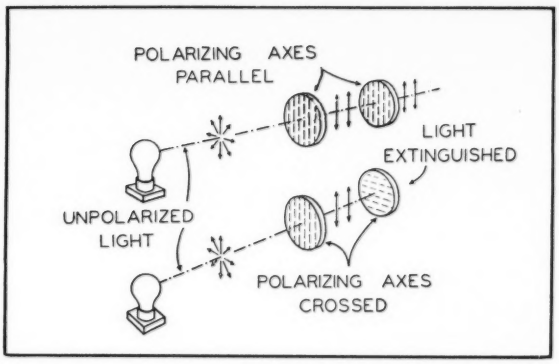


Fig. 2

Now let us shield the direct rays from the source and examine a reflected image of it in a tray of water placed in front of and below the lamp. As we rotate the analyzer this image varies in brightness and, if the reflection from the water is at a particular angle, the image will become totally extinguished for a given position of the analyzer.

We have produced polarized light by reflection and have detected its presence with an analyzer in the form of an absorption-type polarizer. This is the principle employed in sunglasses, camera filters and desk lamps which make use of polarizers to reduce or extinguish polarized glare from reflecting surfaces.

If, when the analyzer is in that position which causes maximum reduction of the lamp's reflected image, we draw a vertical line on it, we will have marked what is termed the polarizing axis of the analyzer. By similarly orienting and marking another Polaroid analyzer we will have prepared a pair of polarizers with markings which will enable us to position them instantly in a predetermined relation. Now, if we place either of our marked polarizers in front of the lamp with its marking *horizintal,* we will find that the *direct* light from the lamp is polarized at the same angle as was the reflected image from the water surface. How do we know this? Our other marked analyzer extinguishes the now-polarized direct rays when its mark is *vertical.* In preparing for a discussion of the application to headlighting, it is very worthwhile to note another unique property of our two marked polarizers: When the one at the lamp has its axis *parallel* to the axis of the other (at the eye) the former does not *appear* to absorb much of the light from the source—in fact appears nearly water white instead of dark. This is visible evidence that practically all of the light which has passed through the polarizer is freely transmitted by the analyzer. This would not be the case with ordinary neutral density filters whose absorptions would build up rapidly to obscure the source.

The foregoing simple experiments serve to illustrate the fundamental fact in psysics that two polarizers with their axes parallel pass a substantial amount of light whereas two polarizers with their axes "crossed" block out the light. (See Figs. 2 and 3.) In the system for eliminating glare from auto headlights, polarizing material is utilized in two places on each car: on the headlight lenses and before the eyes of the driver in the form of a viewer. The fixed orientation of the applied material is such that on any two opposing cars, each driver's viewer is set to extinguish the opposing headlights. Moreover,

the axis of each driver's viewer may be parallel to that of his own headlights and yet have the foregoing condition exist, if an angle of 45° is used for the orientation of all equipment on all cars. This insures that each driver have the maximum opportunity to see by the light of his own lamps, because most of the light going forward through his headlight polarizers will return from the roadway through his similarly oriented viewer.

In any such application of a polarizer to light sources of limited brightness, two properties of the polarizer material are of great importance. First, it is desirable that the material transmit pure polarized light with as little admixed ordinary light as possible. Otherwise the analyzer will not be able to extinguish all of the light which passes the polarizer. Second, the material should transmit as near to 50 per cent of ordinary light as possible. Otherwise, when polarizer and analyzer have their axes parallel they may transmit considerably less than 50 per cent. Thus an absorption-type polarizer which transmits 50 per cent of incident ordinary light in the form of pure linearly polarized light could be said to be 100 per cent efficient. Because of losses due to surface-reflections, this ideal polarizer would actually transmit about 43% of the light. Among the commercially obtainable sheet polarizers, there are available materials which approach very nearly this ideal, transmitting about 40 per cent of ordinary light with a degree of polarization sufficient to permit extinction of all light except for traces at the ends of the visible spectrum.

In addition to having high efficiency, the polarizers used in the automobile system require a high degree of stability. This is especially true of the headlight polarizer. In its exposed position on the front of the car, this material is subjected to extremes of weather, bright sunlight and a temperature of over 300° F. developed in it by the powerful light source used. To meet this series of requirements, a novel polarizer was developed about 10 years ago containing a newly synthesized polarizing molecule. For the less exacting stability requirement of the viewer, a different polarizer is used. The reason for this will be given in a subsequent article dealing with the details of installation, operation and performance of polarized headlighting as well as methods of introducing the system.

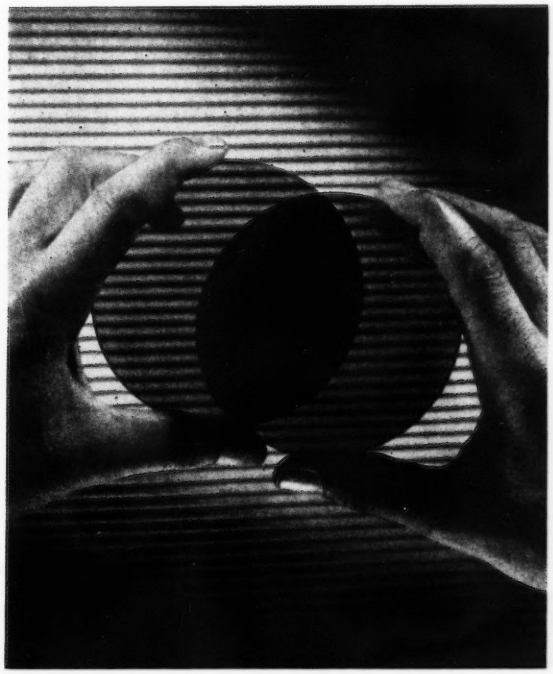


Fig. 3

Report to Congress Shows Highway Development Essential to Maintain Level of U. S. Economy

The recent Joint Committee report to Congress, which totaled current street and highway deficiencies at more that $41 billion, demonstrates that development and maintenance of an adequate system of highways is essential to continued high level of economy in the United States.

Prepared with cooperation of the Bureau of Public Roads and the state highway departments, the report on "Highways and the Nation's Economy" presents a measure of the work to be done in bringing the nation's road systems up to proper standard of efficiency.

It supports the axiom that people pay for good roads whether they get them or not. "The people of the nation receive the benefits of economical transportation in lowered transportation costs of the goods and services they produce and consume," the report points out, "or they pay the added cost of deficient highways in higher transportation and consumer costs."

"The total cost of correcting present deficiencies on the highways, roads and streets of the nation is estimated at $41,144,630,000," the report states. "Of this amount, $7,700,000,000 is estimated as the amount needed for city and village streets, and $10,400,000,000 for correction of deficiencies on the local rural roads. The remaining $23,044,630,320 is the amount needed for the state highway systems and their urban extensions."

Earnings Depend on Highway Transportation

In studying the impact of highways on the national economy, the report takes note of the fact that more than 9,000,000 persons are employed directly or indirectly in highway transportation industries; that many businesses depend solely on patronage of the motorist; that almost all commodities are transported at least partially by motor truck.

"Small savings to individual highway users through road improvements can have a large effect on our economy," the report states. "An average saving of one cent a mile due to savings in time and the cost of motor vehicle operation on the 400,000,000,000 vehicle miles of travel in 1948, would amount to $4,000,000,000 per year."

"Operating cost of the average passenger car, in the pre-war period, was reduced approximately one cent per mile by traveling on a gravel road as compared to a dirt road and approximately one cent per mile by traveling on a bituminous or concrete paved highway as compared to a gravel road." Economic benefits of highway improvement were cited also in reduction of accidents.

Traffic Planning The New Jersey Turnpike

By Charles M. Noble
Chief Engineer, New Jersey Turnpike Authority

THE New Jersey Turnpike will aid materially in solving the problem of congestion and overloading on the State's public highway system. Aside from diverting traffic from existing congested routes, especially of intra-state and interstate truck movements, the Turnpike unquestionably will develop new traffic which does not now exist. It will be an important factor in the current traffic problem.

This problem is unique in that the State is a "corridor" for interstate vehicular movements. New Jersey lies in the center of a group of northeastern states which contains 24 per cent of the population and 35 per cent of the industry of the entire country. It is situated between New York and Pennsylvania, with the first and second largest populations, and between the two great seaports of New York and Philadelphia, the first and third largest cities in the country; and the richest marketing areas.

All highway traffic between these cities, as well as that to New York City from the south and west, and practically all highway traffic from eastern New York and New England passes through New Jersey.

What this means in traffic volume is indicated by a few statistics. On U. S. Highway No. 1, in Newark, the average daily traffic, 365 days a year, is 61,000 vehicles, and upwards of 100,000 vehicles have been recorded.

For traffic moving to and from the State's shore resorts, an average of seven cars now use bridge crossings over the Raritan River for every five in 1938, an increase of 40 per cent. The Edison and Victory bridges in this area, in the ten year period ended 1948, showed an increase of 65 per cent. Nowhere in the world is traffic so dense as in these two areas. And traffic experts are forecasting that highway travel in New Jersey will double by 1970.

These facts, together with the prediction of what lies ahead, clearly indicate the need for a major north-south traffic artery such as the Turnpike, if relief from congestion and overloading on the State's highways is to be forthcoming quickly.

All the highway facilities that are urgently needed in the State cannot be provided in the normal manner because (1) the finances available for such purposes are not adequate, and (2) the highway construction program was retarded by the recent World War which resulted in the placing of restrictions on the use of materials and a shortage of manpower.

Moreover, the public is reluctant to authorize new bond issues for highway construction and it is politically impracticable to increase gasoline and other taxes to pay for them. This condition applies not alone to New Jersey, but to most other states as well. The only logical alternative in the public interest, hence, is the turnpike, or toll road, to be financed as a self-supporting project with private capital.

For the State Highway Department to undertake a project such as the Turnpike, and to continue its normal construction program, would require from 35 to 50 years for its completion. If the State were to use all the funds available to it for new construction—approximately $25,000,000 annually—it would require about ten years to build the Turnpike. And, needed new construction elsewhere in the State could not be undertaken meanwhile.

The Turnpike is Born

The law creating the New Jersey Turnpike Authority, which is building the State's new superhighway, was passed by the Legislature in October, 1948. Known as "The Turnpike Act of 1948", it was originated and sponsored by Governor Driscoll who, earlier, recognized that the State's highway requirements "are so acute that it is apparent that we cannot hope to finance the construction and completion of major highways which have been legislated, planned or discussed, out of current income."

The Authority comprises three Commissioners who serve without compensation. They were appointed by Governor Driscoll last March, and were confirmed by the State Senate. They are Paul L. Troast, a builder of Passaic, who has been named chairman; George F. Smith, president of Johnson and Johnson, who has been named vice-chairman, and Maxwell Lester, Jr., of Summit, a broker, who has been named treasurer.

Immediately upon their appointment the Commissioners tackled the job of getting the Turnpike under way. One of their first tasks involved the obtaining of preliminary surveys from nationally recognized engineering firms in the highway field to supply the answers to such questions as route; the cost of construction; how many vehicles are likely to use the Turnpike and where vehicles are most likely to enter and leave; potential revenues to see if the project would be self-supporting; how to cross various important rail and traffic arteries; topographical conditions, and many other basic details.

These surveys were completed in the record time of four months and were submitted to the Commissioners on September 14, last. They disclosed that the project was necessary, that it would be self-supporting and, therefore, financeable. Engineering firms with about 600 men then were engaged in the field to stake out locations and recommend a detailed alignment. They were discussed with elected officials in the various counties traversed by the Turnpike.

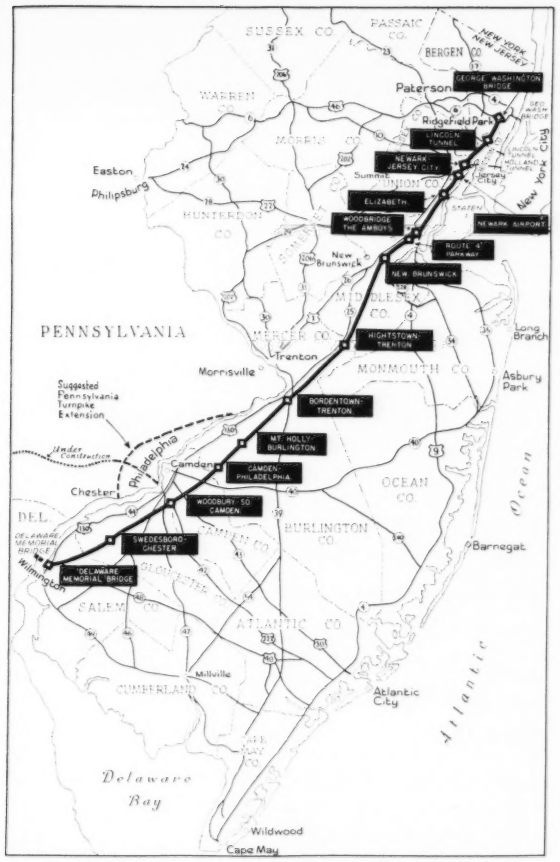


Fig. 1

It is interesting to note that at meetings with elected officials the general opinion was (1) that the Turnpike is urgently needed to relieve congestion; (2) that, with a very few exceptions which were resolved, the recommended alignment of the engineers met with approval, and (3) that this new superhighway will result in many benefits for the State, its people, its industry, agriculture and commerce.

Construction Facts and Figures

New Jersey's new Turnpike will be a back-bone road extending 118 miles from the northern end of the State, near the George Washington Bridge, to Deepwater, N. J., in the south, where it will connect directly with the Delaware Memorial Bridge now under construction. It will have thirteen traffic interchanges along its route, in addition to the two at the northern and southern terminals (See Fig. 1.) These interchanges will provide ready access to and from the Turnpike through connections with leading east-west public highways. In this manner, the Turnpike will serve the entire State in a manner heretofore impossible of attainment.

This new superhighway will be the last word in a safe, all-weather facility that the most modern engineering techniques, advanced theories and full experience can produce. It will provide direct connections to the cities of Wilmington, Philadelphia, Camden, Trenton, New Brunswick, Elizabeth, Newark, Jersey City, Passaic, Paterson and all of the many other communities in the State as well as to those in New York, Pennsylvania and Delaware.

There is no highway of equivalent length in the United States which will compare with this Turnpike in its direct connections with tremendous concentrations of people, buildings, industry, wealth, commercial activity and highway movements.

The cost of construction of the New Jersey Turnpike is estimated at $150,000,000. That sum, together with costs for engineering and acquisition of right-of-way, repayments to the State Highway Department, contingencies which may or may not occur, financing and other costs, will require a total financing of $220,000,000. Such funds were successfully obtained from the sale of revenue bonds to private investors. No taxpayers' money will be used whatever in the construction, operation or maintenance of the project. And, neither the faith nor credit of the State, its counties or municipalities will be pledged in this financing. The Turnpike will be a self-supporting project, deriving its income from reasonable tolls and from concessions such as service stations and restaurants.

The method of financing for the Turnpike is unique in that it represents a departure from methods heretofore in use for construction projects, especially one that requires such a large capital investment to build and place in operation.

It is estimated that, because of this unusual plan, the Authority will effect total savings of upwards of $12,000,000 in interest cost during the period of construction and in other financing costs which would have been incurred had a public offering of bonds been made through regularly established channels.

An additional advantage is that, in effect, the amount of savings in bond discount and interest during construction would double during the life of the issue since bonds to that extent would not be outstanding.

Under the plan which has been adopted, the subscribing investors provide, immediately, a 'forward Commitment' for the full amount of $220,000,000 for the construction and initial operation of the Turnpike. For this commitment the Authority agreed to pay a nominal fee of one-half of one per cent annually. As funds are required for the project during its construction, the Authority will draw against the commitment and then issue definitive bonds for the amount borrowed, continuing to pay the nominal fee on the remaining unused commitment. The definitive bonds will carry an interest rate of 3¼ per cent annually, such interest to be paid semi-anually.

In contrast, an offering of bonds to the public would have involved additional interest and other costs as the result of the need for an immediate sale of the entire issue which, incidentally, would have been greater than that under the commitment plan; the requirement that additional reserves be set up and for which bonds would have to be sold; the probability of a higher interest rate; the fact that there would be no competitive bidding for such a construction issue because of its size, and the possible difficulties of sale of so large an issue at one time, unless institutional investors subscribed for a substantial part of it.

The Turnpike is scheduled to be completed and ready for use in November, 1951. To attain that objective all construction work will be accomplished during the working seasons of 1950 and 1951. A program of this magnitude will be possible only through the employment of a large number of contracting firms to whom appropriate portions of the work are being assigned after competitive bidding.

In addition, all portions of the construction work must be handled in proper sequence so that as each contractor finishes his part, the other parts will be completed at the same time. Thus the entire length of the Turnpike will be placed in operation at one time.

Engineers for the Turnpike estimate that this project will require employment of from 2,000 to 7,000 skilled workers, and from 3,000 to 11,000 unskilled workers. This is aside from the approximately 500 to be employed by the Authority, itself, in the operation and maintenance of the highway.

Traffic Design Features

Meanwhile, plans for design and specifications are in preparation and advertisements, seeking bids for work on various sections, have been placed. Bids for the first contract in Linden, N. J., were received on December 20.

From the standpoint of construction, the Turnpike will have long easy curves, long sight distances and minimum grades (no grade will be more than three per cent) to assure the safest of driving conditions at speeds to be established by the Authority. Time savings in travel on the Turnpike will range up to 47 per cent as compared to the nearest competitive highway under the most favorable conditions.

There will be no cross roads, no left turns and no red lights for its entire length. There will be a wide dividing strip between north and south multi-travel lanes to avoid head-on collisions and visual interference from oncoming car lights at night. And the Turnpike will be fenced to prevent its use by pedestrians and other unauthorized persons.

Service areas for the comfort and convenience of Turnpike users also will be provided. There will be service stations for the sale of gasoline, oil, accessories and minor repairs, and restaurants to serve full-course meals or "snacks". All of these facilities will be set back well from the travel lanes proper to avoid conflict with moving vehicles. And ample parking space will be provided at all of these facilities. (See Fig. 2.)

Prior to entering, or leaving, the service facilities, or the Turnpike's interchanges, lanes of 1,200 feet, in addition to the travel lanes proper, will be provided for increasing or decreasing speeds so that merging with Turnpike or urban traffic will be easy and safe.

Special attention will be given to the design and construction of traffic interchanges on the New Jersey Turnpike to afford the maximum in safe driving conditions at all times. (See cover photo.) Such interchanges, where vehicles may enter or leave, will be strategically located along the Turnpike.

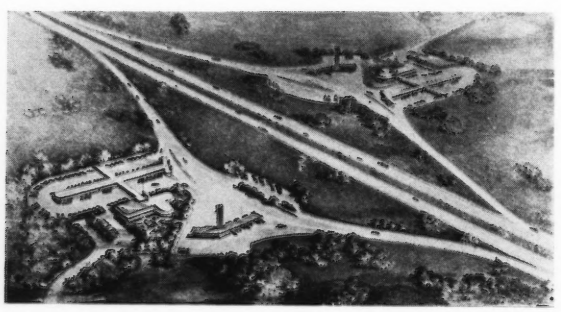


Fig. 2

The efficiency and safety of traffic on a superhighway such as the New Jersey Turnpike will depend largely on adequate and free-flowing facilities at interchanges. The design of these interchanges will be consistent with the high speed characteristic of the Turnpike.

Improperly planned entrance facilities can seriously limit traffic volumes on the Turnpike. Exit facilities incapable of easily accommodating vehicles under peak conditions can cause traffic to be congested.

The interchanges will be so designed that these handicaps will not exist. Interchange traffic lanes will be wider than is customary on straight-a-ways and they will have generous curvatures to permit a higher-than-average rate of speed with safety.

In addition to these amply wide travel lanes there will be completely finished shoulders of ten feet on the right side and of five feet on the left side of interchange lanes. Such shoulders will provide for emergency parking of disabled vehicles and permit of uninterrupted traffic movements on and off the Turnpike.

In these wider lanes and easier curves, there also will be an allowance for so-called 'imperfect' driving which results from high speeds where curvatures are constricted, forcing motorists to 'hug' center and outer markings or shoulders.

Specifications call for three types of interchange lanes, depending on the density of travel at the particular point. There will be a one-way one-lane travel with a minimum width of 16.5 feet; one-way two-lane travel with a minimum width of 26.5 feet; and two-way two-lane travel with a minimum width of 30 feet. All widths are exclusive of shoulders on the outer and inner sides.

These interchange lanes will be adequately wide to permit of safe and easy handling of the largest trucks now on the highways.

The widths of one-way two lanes and the two-way two-lanes, moreover, will permit a passenger vehicle or truck to pass another truck with a clearance of four feet between vehicles, and provide an additional two-feet clearance at each curb or shoulder line.

As an added safety feature, two-way traffic interchange lanes will be divided by a four-foot median curbed strip.

The engineers have given considerable study to the factors of safety, comfort and speed on the Turnpike and every known and practical device to attain these objectives has been provided for in its design.

This Turnpike will be an important project for New Jersey. It will contribute measurably to the growth and development of the State as a whole, providing many benefits to its residents, agriculture, industry and commerce.

Forecast

The concensus of 27 Detroit automotive writers is that nearly 5½ million motor vehicles will be built during 1950. Of this nearly 4½ million will be passenger cars and the balance trucks and buses.

The forecasts would place 1950 below the record 1949 level but above any other previous year. In 1949 there were 5,120,000 passenger cars and 1,130,000 trucks and buses produced, an all time high.

In the five pre-war years of 1937 through 1941 the industry averaged 3,256,000 passenger vehicles and 781,000 trucks and buses annually.

Help Yourself - To Help From Public Transit

By Donald H. Walker
President, Fort Wayne Transit, Inc., Fort Wayne, Indiana

SOME time ago the author was asked to discuss the interest of public utilities in traffic problems. The electric, gas, water and telephone utilities are somewhat involved in this, but for transit, the word "interest" is too mild. We live with this problem even more than traffic engineers do because they have to sleep now and then, while our vehicles battle traffic all day and all, or most, of the night.

I understand that traffic engineers *do* have a few traffic problems, such as:

1. To secure maximum use of streets now partly used, by reducing congestion and delay.
2. To increase safety on those streets.
3. To recommend regulations that police can (and will) enforce.
4. To keep elected city officials happy.
5. To keep merchants happy.
6. To keep pedestrians happy.
7. To keep motorists happy.
8. *And even,* to keep transit companies happy.

At least we have one advantage in this respect. Almost anything the traffic engineer can do to speed up general traffic and reduce delays will help us too, and he will find us more willing to cooperate than some of the other groups.

A noted traffic engineer recently said, "Tomorrow the downtown districts may be studded with the abandoned remains of buildings, as are the cities of Europe today." Another commentator on this subject expressed his view in this manner, "The parking problem is the great American fumble—a huge practical joke that we persist in playing on ourselves."

You and I know that today's congestion problems are caused by the private automobile. Does that statement mean that transit is prejudiced in presenting its views? Definitely not! We know we could not even begin to carry the entire passenger load in any city of any state—*but,* in none of the larger ones at least, could that load be handled without us.

For instance, in Fort Wayne a cordon-count about two years ago showed that of those entering the business district, about one in eight walked. Of the remainder, fifty-four per cent reached the business district by automobile and forty-six per cent by transit vehicles. The picture has not changed much since then. Of course, the larger the city, the greater the proportion carried by transit.

Our streets are narrow—42 feet wide through the business district on our main street, Calhoun, with most of the stores and office buildings on this street or within a block of it, and seven or eight "through" transit lines running right down this main thoroughfare.

A four-hour check made recently on Calhoun Street showed transit vehicles comprising 25% of the traffic (a rather high figure), but carrying 85% of the *people* using the street. It is interesting to note that passengers per auto varied from 1.49 to 1.80 in 15-minute periods of the check and averaged 1.64 for the entire time. This is close to the national average of 1.7 people per car.

Some Authoritative Views

The American Road Builders Association published a report of their Committee on Mass Transportation (as Technical Bulletin No. 139) in 1948. They canvassed officials of 312 cities over 25,000 and had returns from 112 (36%). That report says: "We have conclusive evidence (from the 112 replies) that public officials view a modern system of local mass transportation as a community essentiality and a material aid in helping to solve the growing problem of street congestion, particularly in the middle-size and larger cities."

This report also states that—"—public officials in cities of all sizes feel that the elimination of curb parking would greatly speed up not only mass transportation service, but all other moving traffic and reduce street congestion."

Probably most of you are familiar with a 1948 publication of the Eno Foundation for Highway Traffic Control titled "The Prohibition of Curb Parking". From that I quote: "Many streets in downtown districts accommodate large volumes of commercial vehicles and public carriers. Obviously, consideration must be given to the needs of these vehicles for loading and unloading. However, their needs cannot be evaluated to the exclusion of those of private motorists—every effort should be made to relieve the demands of transit and commercial vehicles for space at the curb."

Not all transit companies or their representatives feel the same way about the parking problem. For instance, many times you may have seen transit ads advising "Leave your car at home for your wife to shop, and ride with us to work." A few weeks ago a man with years of transit experience advocated an entirely new viewpoint on this. Taking cognizance of the fact that the rush hour load is unprofitable because such a large proportion of equipment can only be used for a few hours a day, Felix E. Reifschneider, in November, 1948 MASS TRANSPORTATION, said, "Why not urge downtown workers to use their autos for going to work, and park them on the downtown streets? This will lighten the rush hour load, which is particularly unprofitable these days. . . . Every development of the last few years has made extra service during rush hours more and more expensive to operate. . . .

"If downtown employees take all the parking space, then shoppers who drive downtown later will be unable to find any place to park, and will be obliged to use transit vehicles. . . .

"Traffic congestion during the day would be reduced because autos wouldn't be shifting from one parking place to another at frequent intervals, and there would be less frequent turnover in use of parking spaces. . . . The mid-day auto user would cease to cruise looking for parking space as soon as he learned that none was available." Maybe that is an easy answer to all of our problems!

Although different elements cause traffic congestion in different cities, there are many features common to most locations. We do know that the congestion is there, and our present streets in almost all instances must serve for a long, long time. It *could* be much worse in any of your cities without transit to help reduce congestion. Charles J. Walker, City Traffic Engineer of Gary, Indiana, gave a very complete discussion of the arguments for near-side or far-side stops at the Purdue Road School two years ago. He stated in his opening paragraph: "Today, without mass transit facilities, cities would cease to exist and there would be no urban traffic problems. Therefore, if we are to prolong the life of our cities, we are obliged to plan the very best possible transit facilities, laying emphasis upon both economy of operation and safety to the public."

Now the average transit company holds no brief for stops on the near-side or the far-side of an intersection. The only question is, which will do the best job. Let's follow through on a Fort Wayne experience.

Near-side vs. Far-side Stops

On Calhoun Street, previously mentioned as our main business thoroughfare, street cars were operated until June 27, 1947, with trolley coaches operating in the car track area also. On August 9, 1947, all stops in the former car track area were abandoned, and we pulled to the curb for loading and unloading our trolley coaches, and an occasional gas bus, for ten blocks in the center of the business district on Calhoun. After a period of operation in this manner, we made a comparison of *traffic* accidents involving our vehicles in any way, regardless of who was at fault, for the first seven months of 1947 (in the center of the street) and 1948 (with near-side curb stops).

The results here were rather startling. The transit system as a whole had a 5% *decrease* in accidents, but on this stretch of Calhoun there were 22% *more* accidents. Most of the increase involved other vehicles turning right into the intersecting streets and our vehicles pulling away from the near-side stops.

Certain types of accidents decreased sharply. When street cars and trolley coaches were operating in the center of the street, it was common for autos to plow into the rear of standing transit vehicles. This type of accident was reduced more than half when buses pulled to the curb. Accidents involving pedestrians were reduced from seven to three. Despite these decreases, there were 25 more accidents involving transit vehicles on this stretch of Calhoun Street.

Following a study of these statistics, we agreed with the city traffic and police officials on a trial change to far-side stops in this area. Our blocks are just slightly over 300 feet long and only three of our coaches can unload at the curb in the half block on the far side, so that actually we have mid-block stops for individual coaches as each coach pulls up to the alley for unloading if the space is clear.

Far-side stops were instituted on September 20, 1948. In January of 1949, we made an accident comparison for this section of Calhoun for the last three months of the years 1947 and 1948. We found that traffic accidents involving transit vehicles decreased from 85 to 47, a drop of 45%. The reduction, or practical elimination, of two types of accidents chiefly accounted for the difference. Accidents involving right-hand turns of automobiles in front of our vehicles at various corners were almost entirely eliminated. Accidents involving coaches pulling from the curb into the line of traffic were greatly reduced.

We do not have any actual data or checks regarding the effect on general traffic conditions on Calhoun, but several competent observers have expressed the unanimous opinion that a much greater volume of vehicular traffic is being handled on Calhoun, and there is appreciably less delay in moving all traffic through this section. Traffic engineers are all interested in accident reduction, more volume and less delay—so, just *help yourself to a little help from transit!*

Times Have Changed

Conditions change in a few years. In 1944 a leading traffic engineer, D. Grant Mickel, in "Solutions to Local Parking Problems", discussing commercial parking operations in cities of 50,000 to 200,000 said, "In these towns, *ten cents for all-day parking is the limit most motorists will pay even for a choice central location.*" How many traffic engineers from cities of that size could find a choice central location parking lot with a dime fee today?

Don't be afraid to suggest trying something that has not been done before—if you are convinced it is sound. Remember the story of Boss Kettering of General Motors when he was told it was impossible to drive from Detroit to Dayton in less than a certain time. He is reported to have taken his fellow worker down there easily in a half-hour less, but the chap wailed—"Of course you did it, but you didn't stick to Route 25." It may be time to change routes.

Translate Facts Into Action

May I stress the importance of doing something after you get your facts. One single corner situation remedied by action is worth reams of grandiloquent reports on over-all plans—with no action. Use a little intelligent selfishness. Make your own way easier by making it easier for the other fellow.

What does transit want you to do? Well, here are a few actions that could be considered, if they have not already been done in your community:

a) Adequate bus loading zones—*well marked*—if you want travel lanes left clear.
b) Center marking on narrow streets—if you want the big vehicles to stay on their own side.
c) Through street designation generally on transit routes—if you want to keep down intersection accidents.
d) Consideration of changes in signal timing and prohibition of turning movements at some locations—if you want to move people through the intersections 50 at a time instead of 1.7 per vehicle.
e) Sensible parking restrictions in the rush hours—if you want to move *all traffic*.
f) Eternal reiteration—to all groups—of the advantages of staggered hours—if you are looking for the quickest way to increase street capacities.
g) Consider the place of transit in your plans, and give us a chance to present our views *before* changes are made.

Our community of interest is unmistakable. By working together we *can* better conditions for *all* users of the streets.

Winter Traffic Survey Problems In The Small City

By Ralph W. Borrowman (Assoc. Mem., ITE)
Associate Planner, Metropolitan Plan-Greater Winnipeg, Winnipeg, Canada

How would you like to make a traffic survey in the middle of winter with temperatures ranging from 30 degrees above to 30 degrees below zero? Combine this with falling snow and a driving 30 m.p.h. wind and you have the conditions under which a traffic survey was conducted last winter in St. Boniface, Manitoba.

While these are not uncommon winter conditions in Canada, they are certainly not the usual thing, nor are they the ideal conditions one would normally choose for outdoor surveys of any kind. They were the conditions, however, under which it was found necessary, or at least expedient, to accumulate certain factual data.

St. Boniface is a city of 25,200 population, located to the southeast, and immediately across the Red River from the Provincial Capital at Winnipeg. In common with many cities of its size and population, St. Boniface has its traffic problems, and its normal share of budget and finance difficulties. To date it has been impossible to establish a traffic engineering department, or even a full time traffic engineer, and traffic problems are generally handled by a committee of City Council with the Chief of Police as advisor.

Such a body is not in a position to conduct fact-finding surveys itself, and generaly does not have readily accessible funds with which to employ outside technical assistance. This was the situation in St. Boniface. The city was, however, in the fortunate position of being an active member of the Metropolitan Planning Commission, and through this affiliation could obtain the necessary assistance of the technical staff of that planning organization.

To the Commission was sent a request for study and report upon several items which were related but not necessarily dependent upon one another. These included a survey of the need for traffic signal lights, for additional parking regulations, for off-street parking facilities, for speed zoning in one area, for through streets in another area, and for elimination of truck travel in a third area.

Photograph by Kucera of Winnipeg

Fig. 1

Such problems as these are every day run-of-the-mill studies under normal conditions and as such are only of passing interest to the traffic engineer. The survey as it was carried out, however, should be of interest for several reasons. First of all, it indicates one way in which a small city with limited resources obtained necessary factual data at relatively little expense. Secondly, it illustrates problems in weather conditions not normally encountered. Thirdly, it points up some of the difficulties involved with the use of automatic counters and road tubes in urban areas.

The Problem of Automatic Counting

The major part of the survey resolved itself largely into a determination of traffic volumes and densities, plus a study of street parking. The biggest problem arose in deciding how best to gather the necessary traffic movement data. It was not financially possible to conduct extensive hand counts, nor was this considered desirable from the point of view of accuracy of results in inclement weather. Probably the best plan would have been to use some type of electronic counter, but it was considered that delivery and installation of this equipment would have consumed more time than was available. The selection of some other more readily available type of automatic counter was therefore necessary. It was finally decided to employ automatic trafficounters with standard road tubes, since the Provincial Government Highways Branch offered to lend a number of these for the survey, and to provide the necessary technical assistance for installation and maintenance of the equipment provided.

The plan was to establish counters on both sides of the road on each leg of any intersection under study. These counters were left in place for a period of one week to provide data on all traffic moving into and out of each intersection. Counters were located directly opposite each other at a position approximately mid-block so as to eliminate the dragging of road tubes by vehicles braking to a stop at the intersection. Standard road barriers were placed in the center of the roadway to separate opposing traffic flows. As illustrated in Figure 1, a single road tube was usually laid down between each pair of counters, and was pinched off at the center below the road barrier to provide separate registration of traffic in each direction. This was the general practice, but as noted later, a different arrangement was required where street car tracks occurred.

Photograph by Kucera of Winnipeg

Fig. 2

Since only eight counters were available when the survey started, it was necessary to count each intersection separately without the benefit of a master station to correlate data. While a master station was desirable, it was not possible to establish one with the equipment at hand. Some correlation of data was achieved where possible by counting adjacent intersections in succeeding weeks, leaving one pair of counters in place for two weeks to provide comparative data for each pair of intersections.

The fact that road tubes were required, however, complicated the problem somewhat, since their use involved snow clearing and supervision. The survey was conducted in the months of February and March toward the end of the winter. During the winter months previous to this, a great deal of snow had fallen and wind-rows of snow from previous snow clearing operations were piled on both sides of the road, varying in height up to five feet above normal road level, and encroaching several feet over the paved area. While there remained a cleared roadway adequate for two lane movement in some places it was necessary to widen this roadway several feet on each side to permit the installation of temporary mid-road traffic dividers and controlled directional travel counts. In this regard, it was necessary to clear snow along both sides of the road for a distance of 50 to 100 feet at most counter stations. This provided a sufficiently long straightway at the counter stations to ensure that vehicles crossed the road tubes at a right angle. If vehicles were caused to swing out around the traffic dividers, and cross the road tubes at an angle even slightly off a right angle, double counting would have resulted, with substantial error in the final results. In addition to clearing at the sides of the road, it was desirable in many places to scarify the hard packed snow and ice road surface to remove ruts and washboard where these had built up. Snow clearing was done using large snow plows when it was possible to get this equipment, but after a snow storm, plows were all pressed into service for clearing roads in other parts of the city. At such times it was necessary to resort to the use of exasperatingly slow hand labor.

At each counter, a cut had to be made by hand perpendicularly through the remaining side drifts, to the curb. Here the road tubes were fastened down, usually by driving spikes into the frozen soil of the boulevard, or into cracks or points in the pavement. It was necessary in each case to carry the cut down to the pavement to permit the road tube to lie flat along the pavement. Each cut had to be of sufficient width to provide a reasonable working space for installation and maintenance purposes, and access had to be provided to the counter mechanism, which was usually fastened to utility poles or street trees.

Operating Difficulties Encountered

Additional factors influencing recording accurately were winds of up to 34 m.p.h. velocity and periodic snowstorms. Together, these caused a certain amount of snow drifting which tended to clog up the roads, particularly near the recording stations. For this reason, fairly frequent inspection tours were necessary to assure accurate recording.

A problem arose with counts on streets over which street cars were routed. Here it was impossible to stretch the road tubes directly across the street, since passing transit vehicles would cut the tubes. This was solved by the use of the previously mentioned temporary traffic dividers which were formed by standard road barrier equipment bearing night lamps and 'KEEP RIGHT' signs. When placed between the two sets of car tracks, these barriers forced vehicular traffic other than street cars to travel with at least the right hand front and back wheels clear of the rails. Road tubes were then fastened down close to the rails, assuring registration of all vehicles except street cars. Data on street cars was taken directly from the transit company schedules.

Another problem encountered during the survey was that of severed road tubes. Close supervision of the equipment showed that this was not the result of vandalism, but was caused mainly by trucks, whose tail gates were down, dragging on the ground and catching the tubes. Some breaks were caused by the occasional horse-drawn sleigh which dragged over and stretched the tubes till they broke. Other possible instances of breakage might have occurred when motor vehicles were forced to brake sharply while passing the tubes, but this seems a rather improbable cause. Fortunately there were few instances of breaks, since relatively little could be done to prevent them. Since counts were carried on continuously for a period of one week, and vehicle totals were automatically inscribed on recording tapes every fifteen minutes, it was possible to determine the actual periods when tubes were out of service, and to weight the recorded data accordingly.

In regard to the operation of the recording mechanism, no trouble was experienced except in the clocks, some of which stopped when the temperatures dropped much below 20 degrees below zero. In anticipation of such trouble, equipment had been winterized, replacing lubricating oil with graphite. Even this, however, did not prove entirely satisfactory, and it would appear that some other lubricant should be found if equipment is to be used in extreme cold. In this connection, a Bardahl light grease thinned with Bardahl light oil has been used in parking meters with a light oil only in the clocks. This combination has worked quite well and might be suitable for trafficounters.

In spite of stopped clocks, vehicle recording was continuous, since clocks were used merely to reference the volumes inscribed on the recording tapes to the corresponding time period of the day. Instances of stopped clocks were not frequent, and occurred during night hours when temperatures were lowest. They were not, therefore, of particular significance since traffic volumes during these hours were also low.

Special Counting Techniques

With the use of automatic counters as described, it was

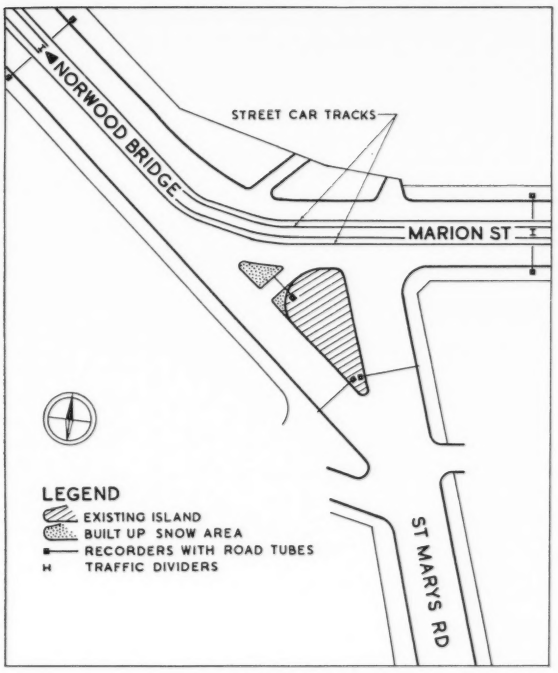


Fig. 3

possible to determine total volumes and densities in each direction on each leg of any standard intersection. In some cases, it was desirable to obtain a summary of all turning movements as well. In such cases, one day visual counts were made, with two observers using push button hand counters to simplify recording at each 15-minute interval. Due to the very cold weather, it was necessary to provide observers with some form of heated shelter. Two types were provided, one being a simple frame shed mounted on skids such as is normally used on construction and repair work. This shelter was provided with a small wood stove, and windows to permit recording of data in comparative comfort. The second type, illustrated in Figure 2, was provided by the Winnipeg Electric Company, and was designed and equipped by the transit company specifically for making field studies of transportation operations. It consists of a small trailer which can be moved readily from place to place as required. Equipped with an electric heater and large windows, it is ideal for use in traffic or transit surveys at any time of the year.

At one of the intersections under study, it was possible to locate the automatic counters so as to provide data on turning movements as well as on total traffic. In this case, snow was put to practical use in the construction of a semi-permanent channelization island. It was necessary to determine the magnitude of a left turn movement through the intersection, and for this purpose, to confine traffic to a sufficiently narrow portion of the roadway as to make use of the automatic counters feasible. Figure 3 illustrates the intersections under study. A large percentage of the traffic moving west on Marion Street normally turned north to Norwood Bridge and the City of Winnipeg, but the actual volume of this movement as compared with the left turn around the existing traffic island by southbound traffic was not known.

In a matter of a few minutes, using a large snow plow, it was fairly easy to throw up, just north of the existing island, an additional small channelization island which provided the desired positional control of left turning vehicles. In addition, this new island provided desirable 'shadowing' and protection for left turning traffic from south and eastbound traffic from Norwood Bridge.

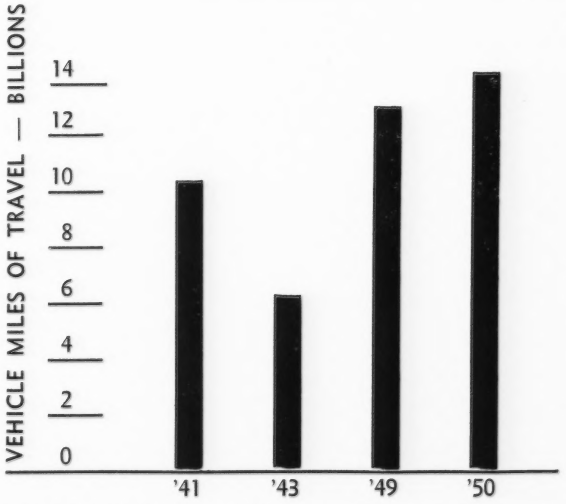
This use of snow for channelization purposes proved quite workable, and the island itself was left intact until spring rains and warm weather caused it to disintegrate. The construction of similar islands for traffic counting purposes may not prove too satisfactory in other locations, but the use of snow for channelization purposes has numerous practical applications. Snow is particularly useful and economical in experimental or trial islands of all types, since with its use, islands can be constructed or removed easily, and their shape and position altered at will.

Small Cities Need Help

The foregoing discussion has dealt rather fully with some of the problems encountered in the traffic counting portion of the survey, and little or no mention has been made of actual data and results. It is sufficient to say that these were fairly standard, and served the purposes for which they were developed. Since it is the type of information commonly assembled by traffic engineers, and since there were no unusual results from the type and conditions of the survey, this discussion does not recount such specific details. By the same reasoning other phases of the survey hold no special interest for traffic engineers and have also been excluded.

No new theories, or conclusions on research are presented in this article. It was considered that these and discussions of major construction projects and the like, are covered quite well in other technical articles by persons well qualified to do so. It is the hope of the writer that this presentation of some of the down-to-earth problems of the small city will encourage increased interest in and assistance for such small cities.

Traffic Trends



TRAVEL ON RURAL ROADS FOR FIRST MONTH OF 1941, 1943, 1949 and 1950.

Based on Bureau of Public Roads Data

Driver Characteristics In Parallel Parking On One-Way Streets

By James A. Gallagher Jr.
District Traffic Engineer, Washington Department of Highways
Vancouver, Washington

"ON which side of a one-way street should parallel parking be allowed?" This question has arisen in the minds of city traffic engineers and the answer has generally been a matter of opinion. A city adopting one-way regulations has many streets too narrow for parking on both sides and must limit parking to either the left or the right side. In an attempt to find a solution to this problem, a study was made of the driver characteristics in the operation of parking on either side of the street.

With the gradual elimination of angle-parking drivers have developed skill and technique in parking their vehicles in a space parallel to the curb. However, parallel parking remains one of the most difficult operations which passenger car drivers encounter. The judgement and skill of the driver and the length of the parking space determine whether or not he will be able to park his car with safety and a minimum of effort and time. Parking on the left side of the street is a new adventure to many drivers in cities that never had one-way streets before.

There are other factors which must be considered in determining the side of the street to permit parking. Some of these are: frequency of fire hydrants and driveways, bus routes, loading zones, and types of business establishments fronting on the street. The cost of moving the parking meters, if used, is another factor if a change is to be made. This study was limited to determining on which side of the street the parking should be, considering only the drivers' ability to park and unpark.

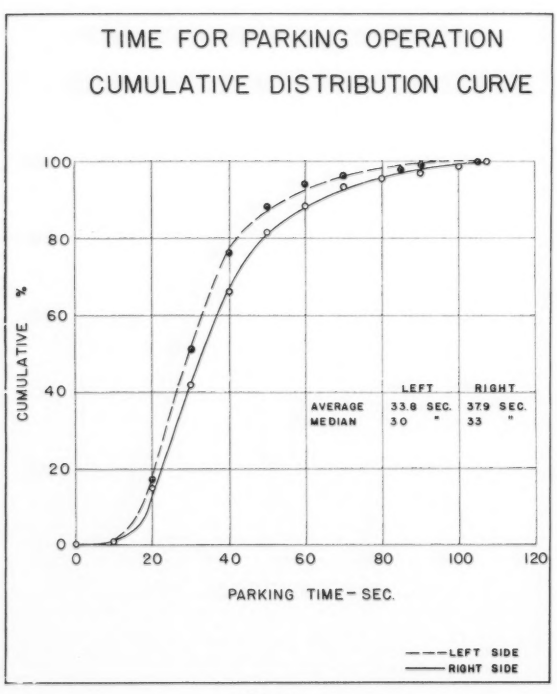


Fig. 1

Method of Study

Obtaining data for this study entailed the observation of automobile drivers in the act of parking parallel to the curb on a one-way street. One requirement necessary was that the vehicle was being parked in a single parking space. As soon as a driver stopped just beyond the vacant space and started the backward movement into the space, a stopwatch was started to determine how long the driver took to complete the parking operation. This operation was considered complete when the vehicle was brought to final rest. The number of maneuvers made in parking the vehicle was also recorded. A parking maneuver was considered to be the motion in one direction only, backing up as one maneuver, and moving ahead as another.

After the driver had stopped his vehicle, data was recorded as to the side of the car he got out, the side the passengers, if any, got out, and whether or not they jaywalked across the street. The side of the street, sex of the driver, year, make and model of the automobile were recorded while the driver was making the parking operation. The position or location of the vehicle in the parking space with relation to the vehicles parked ahead and to the rear was measured, as well as the average distance of the wheels from the curb and the over-all length of the automobile. All measurements were taken to the nearest tenth of a foot.

The one-way street selected for this study has parallel parking on both sides and is metered with a thirty minute parking limit. At this point it is 38.6 feet in width. The parking stalls or spaces were not designated by paint lines, but only by the parking meters which were spaced approximately 20 feet apart.

The street under study is a heavily travelled artery in the downtown business area of New Haven, Connecticut. The average off-peak hourly volume of traffic is 540 vehicles. Field observations were made on days when the weather was good with no rain or snow as it was felt the presence of these weather elements would have an effect upon the parking operation of the drivers. Care was taken

This is the seventh in a series of articles based on student research for thesis requirements. Mr. Gallagher was a member of the class of 1948-49 of the Yale Bureau of Highway Traffic.

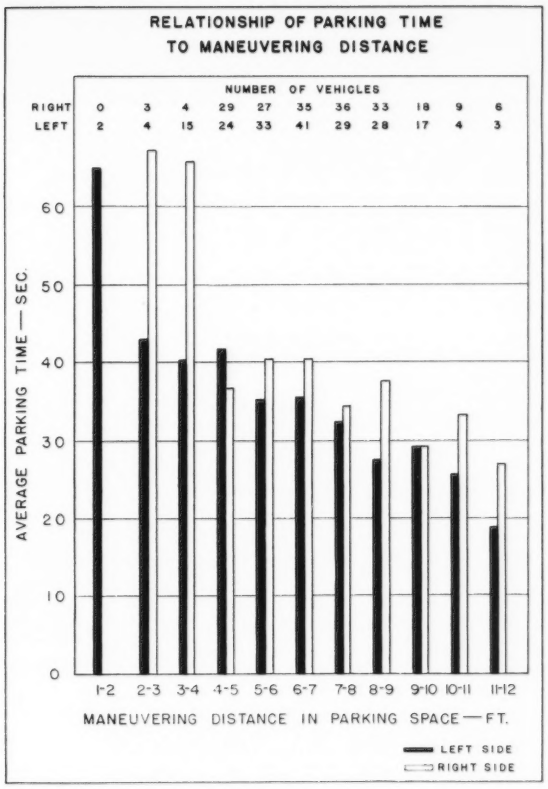

RELATIONSHIP OF PARKING TIME
TO MANEUVERING DISTANCE
NUMBER OF VEHICLES
RIGHT 0 3 4 29 27 35 36 33 18 9 6
LEFT 2 4 15 24 33 41 29 28 17 4 3
AVERAGE PARKING TIME — SEC.
0
10
20
30
40
50
60
1-2 2-3 3-4 4-5 5-6 6-7 7-8 8-9 9-10 10-11 11-12
MANEUVERING DISTANCE IN PARKING SPACE — FT.
LEFT SIDE
RIGHT SIDE

Fig. 2

by the observer and his assistant to prevent the driver from becoming aware of the fact that he was being studied and affecting his actions while maneuvering to park.

Observations were not made during the afternoon peak hours of traffic flow—4:00 to 6:00 P.M.—since a continuous free-moving parking operation could not be made due to interference from the moving traffic stream. The hours of study were from 9:00 to 11:30 A.M. and from 1:00 to 4:00 P.M. on weekdays.

Parking Time

For comparison of driver characteristics, 200 vehicles were observed in the act of parking on each side of the one-way street. The time for parking was tabulated and cumulative distribution curves were drawn as shown in Figure 1. The parking time values for either side of the street were plotted on the same sheet to show the relationship of the time taken for an uninterrupted parking operation. An analysis of these two curves shows that more time was taken for parking on the right side of the street—88% of the drivers parking on the right side took 60 seconds or less to park, while 94% of those on the left side parked in 60 seconds or less. The average parking time for the right side was 37.9 seconds compared with 33.8 seconds for the left side.

The time it takes a driver to park his vehicle is directly related to the length of the vehicle, the length of the parking space, and his skill in parking. The relationship of the first two items to parking time is shown in Figure 2. The parking time values for each foot of maneuvering distance were averaged and plotted in the form of a bar graph.

This chart shows that as the maneuvering distance increased, less time was consumed in the parking operation. It is impossible to measure the skill of the individual driver in parking his vehicle, but it is apparent from this chart that he was able to park quicker as the maneuvering distance increased. Less time was taken for the shorter maneuvering space on the left side than on the right with two exceptions. On the left side, the driver can watch his left front fender more easily and thus know when to turn his front whools at the proper time to maneuver into position next to the curb. On the other hand, the driver in parking on the right side must use caution in backing into the parking space because his visibility in seeing his right front fender is limited and he does not know exactly when he is clear of the vehicle parked ahead and free to turn his front wheels and maneuver into position next to the curb. The vehicle parked to the rear presents no problem to the driver in parking.

Maneuvers Per Parking Operation

The number of maneuvers a driver makes in parking his car is an important part of the parking operation because it is directly related to the amount of interference to moving traffic. The number of maneuvers observed for each operation were summarized and a cumulative distribution curve for each side of the street plotted as shown in Figure 3. An analysis of the curbs reveals that 38.5 per cent of the drivers parking on the right side of the street parked in two maneuvers or less, while 53 per cent on the left side parked in two maneuvers or less. Seventy-nine and a half per cent and 89.5 per cent parked in four maneuvers or less on the right and left sides, respectively. The average number of maneuvers for the left was 2.8 and for the right 3.3.

Those drivers that completed the parking operation in only one maneuver were either experts at handling their car or else left their vehicle in an improper position at the curb against the car behind. If more than four maneuvers were required by the driver, it indicated lack of parking skill or else the maneuvering distance was not adequate.

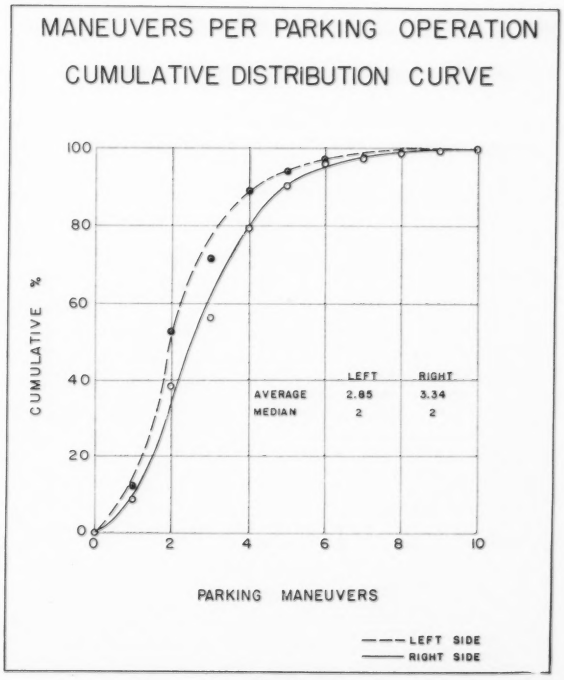


Fig. 3

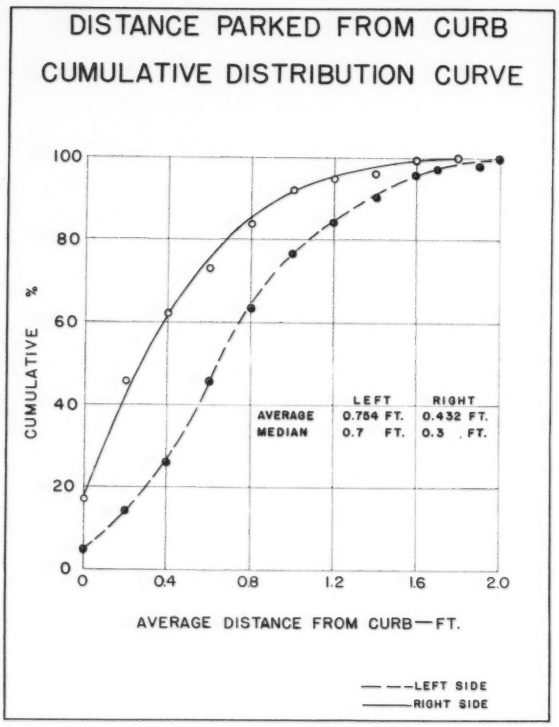


Fig. 4

Distance From the Curb

The position of the parked vehicle was studied to determine the average distance that the driver parked from the curb. Connecticut law specifies that the vehicles shall be parked within 12 inches from the curb. The distance recorded in the field study was the average distance from the curb to the two wheels adjacent to the curb. Some vehicles were observed with the back wheel against the curb, but with the front wheel 3 to 4 feet away.

The vehicles ranged from zero to 1.8 feet on the right side of the street, and from zero to 2.0 feet on the left side of the street. The average for the right was 0.43 feet and for the left 0.75 feet. Cumulative distribution curves, Figure 4, shows this comparison. Seventy-seven per cent were parked at a distance of one foot or less on the left side, compared with 92 per cent on the right.

Numerous drivers parking on the left side of the street were observed to open their left front door while backing into the parking space in order to judge better how close they were approaching the curb. Generally, they reversed the direction of the steering wheel too soon and discovered they were not close enough to the curb when the car became parallel to it. Additional maneuvers were then required to bring the car closer to the curb, or else the vehicle was left parked protruding into the moving traffic lane. In parking on the right side of the street, the driver is unable to see the curb so he "feels" for it as he backs into the parking space. This could be one of the reasons why vehicles are parked nearer the curb on the right side of the street.

The relationship between the distance for maneuvering in the parking space to the average distance parked from the curb was studied the results are shown by the bar graph in Figure 5. This graph shows that as the maneuvering distance increased, vehicles were parked closer to the curb. With one exception values for left side parking were constantly higher than those for parking on the right side of the street.

Distance From Vehicle Ahead

One of the driver characteristics was shown by the distance that his vehicle was parked from the car immediately in front. Normally, the driver is expected to center his vehicle in the parking space, for this will allow the cars ahead and behind normal space to maneuver and unpark from the curb. In this study, the average distance from the car ahead on the left side of the street was 3.59 feet and for the right side 3.68 feet.

Distance From Vehicle Behind

It is just as important that an equal portion of the maneuvering distance in a parking space be left to the rear of a vehicle as to the front. A driver is better able to judge his distance from the vehicle ahead, but this is not always the case with the vehicle to his rear. In backing into the stall, a driver will generally back up until he bumps the rear vehicle's bumper and then moves forward into an approximate centered position in the stall. The average distance from the car behind on the right side of the street was 3.45 feet compared with 3.06 on the left.

Of the 200 vehicles parked on the right side of the street, 56 or 23% were centered within a one-foot distance in the parking space. Thirty-one per cent of the 200 drivers parking on the left side of the street centered their cars within a foot or less in the parking space.

Miscellaneous Information

Incidental data was taken about the driver and pass-

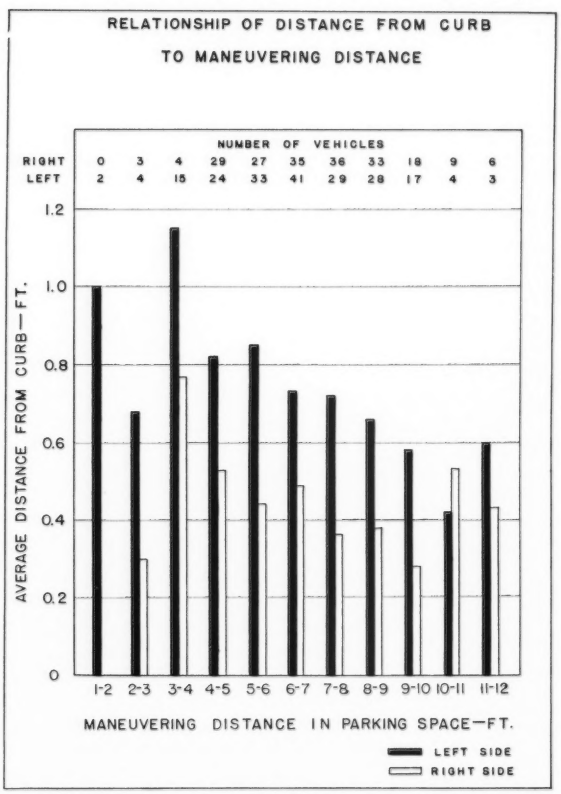


Fig. 5

enger's actions upon leaving the vehicle. It was found that 93.3 per cent of the 179 drivers parking on the left side of the street got out on the left side of the car; 22.6 per cent of the 93 passenger samples got out on the left side. For right side parking 71 per cent of the 175 drivers got out on the left side of the vehicle while 6.1 per cent of the 82 passenger samples got out the left side.

Vehicle occupants were not as prone to jaywalk when the vehicle was parked on the right side of the street. Of the 196 samples studied who got out of vehicles parked on the left side, 28.1 per cent jaywalked. For those from vehicles parked on the right side, 17.6 per cent of a total sample of 182 jaywalked.

Summary

		Left	Right
1.	Average parking time—seconds	33.8	37.9
2.	Average number of maneuvers	2.8	3.3
3.	Average distance from the curb—feet	.75	.43
4.	Average distance from car ahead—feet	3.59	3.68
5.	Average distance from car behind—feet	3.06	3.45
6.	Average length of parking space—feet	23.0	23.4
7.	Length of average vehicle—feet	16.4	
8.	Driver got out the left side—%	93.3	71.0
9.	Driver got out the right side—%	6.7	19.0
10.	Passengers out the left side—%	22.6	6.1
11.	Pasengers out the right side—%	77.4	93.9
12.	Jaywalkers—%	28.1	17.6
13.	Non-jaywalkers—%	71.9	82.4

Conclusions

On the basis of this study, and considering only the parking maneuver, it is evident that left side parking is somewhat to be preferred to right side parking. In the establishment of one-way streets, no difficulty should be encountered in parking when allowed on the left side only, or on both sides.

Are You?

Traffic laws are here to stay—are you? Safety means observing laws, and watching for those who don't. Traffic laws are not annoyances to be ignored. They are for your protection. Don't learn about them by accident!

Reference Notes

By Fred T. Fowler
Traffic Engineer
Portland, Oregon

Illuminated One-way Sign Cabinet

THE photograph illustrates the illuminated one-way sign cabinet which has been developed after a long period of experimentation with various types of illuminated signs. The size of the sign is 24″ x 30″.

This illuminated sign is the standard pattern which is also used on all other plain one-way signs. The 12″ x 36″ one-way sign is not suitable for use since we have "walk-wait" pedestrial signals at most of the intersections and there is no place to install a sign that shape. The illuminated sign is mounted overhead, on the same messenger wire, to the left of the traffic signal. Electric service is obtained from a spare wire in the traffic signal head. The sign is illuminated continuously, and experience indicates that we may expect well over a year's life from each fluorescent tube. Each sign contains two tubes, which will still maintain visibility if one tube burns out.

Maintenance and replacement of tubes is a simple operation requiring only a tower car or a vehicle mounted ladder. Tubes will be replaced according to a schedule which will coincide with one of the regular traffic signal relampings. This will eliminate any additional use of a tower truck for maintenance of the one-way signs.

An important feature of the sign is the simple operation required for access to the inside. One person can open the cabinet, replace a tube and close it again without danger of dropping any of the parts. The cabinet is weatherproof and comparably light in weight. We were able to obtain these locally at a price of $56.00 complete, ready for installation.

TRAFFIC NEWS

Florida Highway Conference to Include Traffic Engineering Sessions

The annual Florida Highway Conference is scheduled for May 11th and 12th at the University of Florida in Gainesville. This conference immediately follows the Florida City Managers' Association meeting in Gainesville which should present additional items. One-half day of the two-day conference has been set aside for a special group discussion devoted to traffic engineering and planning. Subjects to be covered are Parking, One-way Streets and Traffic Administration. Coordination of Governmental Units in the Solution of Traffic Problems will also be included in this special session. Panel members will include representatives of State, County, Large Cities, Small Cities and student body engineering classes at the University of Florida.

Speakers scheduled to participate include: Ross E. Windom, City Manager, St. Petersburg, Florida; Robert Grunow (Mem. ITE), Bureau of Public Roads, Atlanta, Georgia; Walter Parker (Mem., ITE), State Road Department, Tallahassee, Florida; Harry Howard Jr. (Assoc., ITE), City Traffic Engineer, Jacksonville, Florida; R. T. Cunningham, City Engineer, Gainesville, Florida.

Traffic Engineers Meet In Memphis

Approximately 35 traffic and highway engineers, including 25 ITE members, attended the traffic engineering sessions held recently in Memphis, Tennessee, in connection with the 11th Annual Southern Safety Conference. The Board of Direction, ITE, also convened during the conference and action taken is reviewed in this issue in the Secretary's Column.

Nathan Cherniack, Vice-President of the Institute, and Transportation Economist, Port of New York Authority, presided at the opening session on Monday afternoon, March 6th. Ted Matson, Director, Yale Bureau of Highway Traffic, opened the session with a very interesting over-view of Accident and Traffic Data in Traffic Engineering. He pointed out the need for thorough analysis of contemplated traffic improvements before selecting the type of survey necessary to obtain the essential traffic data.

In the absence of Earl Reeder, Director, Traffic and Transportation Division, City of Miami, Harry Neal, Vice-President of the Institute, and Chief Engineer, Traffic & Safety, Ohio Department of Highways, presented Mr. Reeder's paper on Public Support For Traffic Engineering, illustrating means of obtaining public support by methods used in the City of Miami.

Herman Hoose, Traffic Engineer of Charlotte, N. C., explained to the group how traffic engineering services for accident prone and congested locations can be provided small towns and rural areas. Mr. Hoose's remarks were pointed toward commercial development along rural highways and in small communities, and methods of access and egress from such properties.

The final paper was presented by Wortham Dibble, Traffic Consultant, Smith-Dibble and Company, on the subject of traffic control at drive-in theatres. Mr. Dibble explained the problem as it now affects such installations in the southern states, and the methods now being utilized to effectively control traffic to and from urban areas to these outlying theatres.

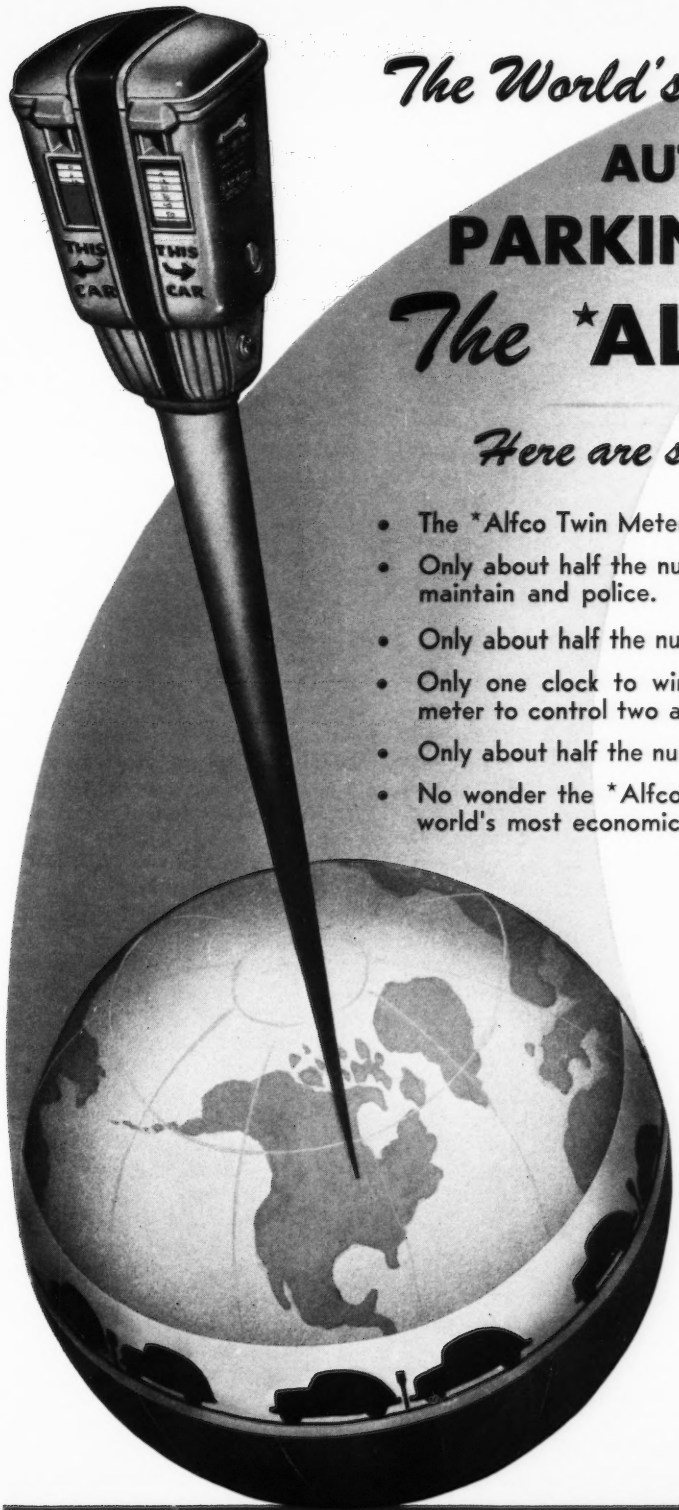
Following a very interesting discussion on the papers presented in the afternoon session, the group was conducted on a traffic tour of Memphis and vicinity by William P. Huntzicker, Secretary, Memphis Traffic Advisory Commission. In a two-hour tour, Mr. Huntzicker showed the delegates some of the interesting developments and improvements being made through traffic engineering techniques in the City of Memphis. The tour also included a trip across the new Mississippi River highway bridge into the outskirts of West Memphis, Arkansas.

On Tuesday morning, 25 ITE'ers sat down to an informal "dutch-treat" breakfast. This was an opportunity rarely afforded the widely scattered members in the southern states to get together on an informal basis. No speeches or discussions were held at this breakfast session.

Henry W. Osborne, Secretary-Treasurer, ITE, and Traffic Engineer, City of Buffalo, presided at the Tuesday afternoon session. Mr. A. E. Johnson, Chief Engineer, Arkansas State Highway Department, and Regional Vice-President, American Association of State Highway Officials, opened the session with a very interesting paper on "Application of Traffic Engineering Methods, Devices and Design to Typical Locations". Mr. Johnson is an extremely "traffic-minded" Chief Engineer and was thoroughly conversant in the most effective means of applying traffic engineering techniques in the solution of highway design problems.

Following Mr. Johnson's remarks, Charles S. LeCraw Jr., Assistant Vice-President, Ramp Buildings Corporation, lead a panel session on "The Parking Problem—Models 1950, 1960 and 1970". Participants in the panel included: In Smaller Towns and Cities, Arthur M. White, Assistant Engineer of Maintenance, Mississippi Highway Department; In Suburban and Residential Shopping Centers, Paul L. Ristroph, Traffic Engineer, New Orleans Public Service, Inc.; In Down-town Areas, H. A. Flanakin, Associate Professor of Civil Engineering, Louisiana State University; Off-street Parking Garages, John T. Hanna, Associate Traffic Engineer, Department of Public Safety, Richmond, Virginia.

After a brief discussion by the panel participants, the entire group pitched in and discussed the parking problem long after the meeting was officially adjourned. Included in the group were three citizen representa-



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tives of the Memphis Traffic Advisory Commission. Their participation considerably enhanced the discussion and brought out very effectively the citizens' viewpoint when attempting to solve the downtown parking problem.

The traffic engineering sessions at the Southern Safety Conference now appear to be a continuing and popular feature. It is anticipated that a much larger group will attend the sessions to be held in Birmingham, Alabama, next year. Harvey Booth, Traffic Engineer, Little Rock, Arkansas, was Chairman of the Traffic Engineering Section this year and personally arranged the very excellent program for the sessions in Memphis.

Lake Shore Markers

Lake Shore permanent aluminum markers are now available in several styles of attractive street signs in both plain and reflectorized finishes which give round-the-clock service.

In addition to being guaranteed *forever* against rust, these signs also carry a guaranty against air-borne acids and alkalis and will withstand the most unusual hazards. These signs have been acclaimed as a solution to street sign maintenance problems.

Catalogues may be obtained from the Lake Shore Marker Company, 654 West 19th Street, Erie, Pennsylvania.

W. F. Benson Appointed

W. F. Grote, President, Grote Manufacturing Company, Covington, Kentucky, announces the appointment of Mr. W. F. Benson as Sales Manager of the Sign Division. Mr. Benson is well known for his broad experience in the field of traffic control and has served on many committes relative to traffic.

He was formerly Sales Manager of the Eagle Signal Corporation of Moline, Illinois. His first assignment with the Grote Company will be to prepare a complete, much needed, sign and street-name catalogue.

Good Roads Development in Foreign Countries

By B. C. Budd
Chairman, Board of Directors, International Road Federation

The history of the good roads movement which swept the United States at the turn of the century is being repeated in a streamlined variation today in many foreign countries where road development has been neglected.

Until the end of the nineteenth century, the U. S. public generally was indifferent to the highway problem. Our highway system today, however, is largely the result of organized popular demand.

This change started here a half century ago with a few pioneers who stimulated a "road conscious" mentality. Organized public interest developed and with it road law reforms, and federal, state and local highway programs.

The International Road Federation, with regional headquarters in Washington and London, today is following the same pattern in promoting good roads on a world-wide basis.

It is providing the stimulus, organizational groups, education, the encouragement and assistance in planning that many countries need for getting sound road programs in operation. It is creating zeal and enthusiasm for good roads—a crusade—similar to that some 50 years ago in the United States.

Mr. Budd is Manager of the Export Division of the Packard Motor Car Company, New York, N. Y.

The Federation is issuing a steady and increasing flow of information to a network of contacts in 38 countries that spread the slogan "Better Living Through Better Roads" from the national and state capitals to the remotest and most inaccessible areas.

People in these countries are learning about roads by IRF channels to newspapers, periodicals, radio and other publications. The populations are learning of the economic advantages which kindle in even the most underprivileged native a desire for roads so he can enjoy a higher standard of living and be able to buy some of the many wonders produced in the world. He is kept informed too on the progress being made in neighboring countries through better road transportation.

In addition, IRF has organized and is continuing to organize national and local road associations in individual nations. The success in this effort, much as in the early good road associations in the United States, merits the attention of not only industry and highway groups here, but the State and Commerce departments and the administration itself.

The federation is one of the best examples of business statesmanship, of what U. S. industry—the motor, petroleum, rubber and construction machinery interests sponsoring it—is doing to extend the hand of goodwill and help to other countries.

This vigorous organization in less than two years since its founding has achieved recognition as one of the most potent non-government forces in international relations.

It maintains close liaison with the U. S. Bureau of Public Roads, the State and Commerce Departments and, through its affiliated road associations, with various government agencies in other countries.

An application is now under consideration for its admittance on a consultative status to the Transport and Communications Commission of the United Nations Economic and Social Council.

Meanwhile, the federation cooperates with private and semi-private national, regional and international groups which have related objectives, such as the Pan American Union, the Federación Interamericana de Automóvil Clubs, and Permanent International Association of Road Congresses, the Pan American Highway Congress and the International Chamber of Commerce.

It works also with the Export-Import Bank and the International Bank in assisting countries to apply for loans for construction equipment and other purchases connected with highway development.

The federation has an agreement with Yale University's Bureau of

Highway Traffic for fellowship awards to engineering students in undeveloped countries and expects to expand the fellowship schedule in 1950-51.

A program for international exchange of technical personnel, developed by IRF, got underway shortly after the middle of October, when the first Mexican highway engineers began a training course with the Texas Highway Department. The State Highway Engineer of Texas has extended this program in order that Texas engineers may be able to work in Mexico with the Mexican Highway Department.

Representatives of IRF attend all international transport meetings as well as such gatherings as the FIAC, the American Association of State Highway Officials Convention and the International Chamber of Commerce Congress.

In addition, an IRF representative is usually available for addressing specialized meetings, such as one last year attended by officials from the British government departments, the British Road Federation and the British Road Traffic Study Group, at which Robert O. Swain, executive director of IRF, explained the principles of traffic engineering (p. 208, Feb., 1950 "Traffic Engineering").

Among IRF's outstanding accomplishments in 1949 was the development of a rural roads program in Mexico financed solely as a result of efforts of IRF'S affiliate, the Asociación Mexicana de Caminos.

The plan, which is a realization of the Federation's ultimate objectives, was developed by AMC and IRF and approved by Mexico's President Miguel Alemán. It provides an estimated 21 million pesos for construction of approximately 1,000 kilometers of farm-to-market roads annually.

Since the plan was adopted last fall, one of several new rural roads started has been finished and is already paying big dividends to the area it serves.

One of the many other examples of how IRF is getting to the grassroots in the many countries in which it is working is Peru. The Asociación Peruana de Caminos has already developed several sub-affiliates in the country and is working with IRF in getting a five-year national road plan for Peru.

The plan is in draft form and is of sufficient breadth and detail to warrant its immediate adoption by the Puruvian government. However, discussions between government people and representatives of IRF disclosed that outside advice would be helpful in implementing the program and reviewing the highway facilities of the Peruvian government.

With this suggestion, IRF's affiliate in Peru requested their government to ask for assistance of the U. S. Bureau of Public Roads. Following a personal survey in December by E. W. James, chief, Inter-American Division of the bureau, Public Roads assigned a technical mission of four men to the Peruvian Highway Department.

At the first of the year, a total of 14 national road associations were affiliated with International Road Federation and organization activities were being conducted in 24 countries.

The history of American road development a half century ago is being repeated today in the many parts of the world where a "road consciousness" has been lacking. The pattern established in the United States, improved, streamlined and varied somewhat, is essentially the same with the roles of pioneer, pamphleteer, organizer, educator and diplomat combined in one central figure—IRF—guided by the principles of business statesmanship at its best.

The Draftsman

With clouding wits the Draftsman sits
And pushes pens and pencils,
While day by day—years slide away
Among his inks and stencils.

He "works" and "works" and "never shirks"
(He couldn't do without it)
And if he stops, *asleep* he drops,
And then he dreams *about* it.

With head that sinks and frame that shrinks,
He does his toilsome duties
Without a glance from gay romance
Or a blink to all her beauties.

And when at last his life is past,
There comes no change to show it;

For *engineers* are dead for *years*
Before they ever know it.

Yale Bureau Announces Fellowships

Theodore M. Matson, Director, Bureau of Highway Traffic, Yale University, recently announced that applications are now being received for ten Graduate Fellowships for the study of traffic engineering during the year 1950-51.

Mr. Matson also made known the major subjects that will make up the course of study for the coming academic year.

Nine of the ten Graduate Fellowships are made available each year through a grant from the Automotive Safety Foundation and the tenth was established by the American Transit Association. Each of the Fellowships provides approximately $1,400 to cover living expenses and tuition for one year, as well as a stipend for individual research projects.

"The problems of traffic accidents and congestion with the growing demand for automotive transportation are challenging the states and cities of this nation," Mr. Matson said. "There is a genuine need for the application of special engineering skills to cope with the planning, design and operation of traffic facilities."

Mr. Matson explained that the awards are open to men who have been granted a degree in some branch of enginering from an accredited college. He added that preference will be given those now employed in street and highway engineering.

The curriculum for the coming year includes the following courses: Highway Traffic Characteristics; Highway Traffic Regulations, Traffic Design, Traffic Planning, Traffic Administration and Practical Traffic Problems. In addition, each student is required to develop a report based on research, which indicates his capacity for advanced work and represents a contribution of original value in highway traffic.

A special form for Fellowship application and additional information may be obtained by writing to the Director, Bureau of Highway Traffic, Strathcona Hall, Yale University, New Haven 11, Conn. The closing date for applications is *June 1, 1950.*

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Highway Definitions

Prepared by the Special Committee on Nomenclature and approved by the American Association of Highway Officials by member department ballots, June 25, 1949, and February 6, 1950.

Introduction

In connection with highway facilities there is wide variation of terms in local, regional, and general use. Already there is evidence of misunderstanding and some confusion in the use of different terms for the same design type or roadway feature of a highway. In the field of urban highways there is an even greater range of terms and meanings, some for the same word. While it is difficult to set up type definitions without introducing conflict with accepted usage in some areas, it seems essential to establish specific definitions for general terms used frequently in conjunction with highway improvements. Such definitions follow. Their adoption may require changes in the generally accepted meanings of terms in some localities but in time such changes would be necessary regardless of the definitions proposed. Uniformity can be approached only by adoption of specific definitions for country-wide use.

The definitions included in Part I are limited in number because the Committee feels that it is desirable to reach agreement, obtain acceptance, and allow time for adoption of use of a few fundamental broad terms and later expand the number of terms offered for such actions. It is recognized that corresponding clarification is needed on many other widely used terms, some of which also are of general nature. The Committee plans to continue work on other more specific terms, but does not wish to delay consideration on this special group of general terms, most of which will be of immediate use in work under way in the standing Committees of the Association.

Types of Highways

Highways, Streets or Roads

A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

(Recommended usage: in urban areas - highway or street - in rural areas - highway or road)

Arterial Highway

A general term denoting a highway primarily for through traffic, usually on a continuous route.

Belt Highway

An arterial highway for carrying traffic partially or entirely around an urban area or portion thereof. (Also called circumferential highway.)

Radial Highway

An arterial highway leading to or from an urban center.

Expressway

A divided arterial highway for through traffic with full or partial control of access and generally with grade separations at intersections.

Control of Access

The condition where the right of owners or occupants of abutting land or other persons to access, light, air, or view in connection with a highway is fully or partially controlled by public authority.

Full control of access means that the authority to control access is exercised to give preference to through traffic by providing access connections with selected public roads only and by prohibiting crossings at grade or direct private driveway connections.

Partial control of access means that the authority to control access is exercised to give preference to through traffic to a degree that, in addition to access connections with selected public roads, there may be some crossings at grade and some private driveway connections.

Freeway

An expressway with full control of access.

Parkway

An arterial highway for non-commercial traffic, with full or partial control of access, and usually located within a park or a ribbon of park-like development.

Toll Road, Bridge, or Tunnel

A highway, bridge, or tunnel open to traffic only upon payment of a direct toll or fee.

Divided Highway

A highway with separate roadways for traffic in opposite directions.

Major Street or Major Highway

An arterial highway with intersections at grade and direct access to abutting property, and on which geometric design and traffic control measures are used to expedite the safe movement of through traffic.

Through Street or Through Highway

Every highway or portion thereof at the entrance to which vehicular traffic from intersecting highways is required by law to stop before entering or crossing the same when stop signs are erected. (Uniform Vehicle Code, Act V)

Local Street or Local Road

A street or road primarily for access to residence, business, or other abutting property.

Frontage Street or Road

A local street or road auxiliary to and located on the side of an arterial highway for service to abutting property and adjacent areas and for control of access.

Cul-de-sac Street

A local street open at one end only and with special provision for turning around.

Dead-end Street

A local street open at one end only without special provision for turning around.

Elements of the Cross Section

Roadway

(General) This portion of a highway, including shoulders, for vehicular use. A divided highway has two or more roadways.

(In construction specifications) The portion of a highway within limits of construction.

Roadbed

The graded portion of a highway, usually considered as the area between the intersections of top and side slopes, upon which the base course, surface course, shoulders and median are constructed.

Subgrade

The portion of the roadbed prepared as a foundation for the base or surface course.

Median

The portion of a divided highway separating the traveled ways for traffic in opposite directions.

Traveled Way

The portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

Shoulder

The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Roadside

A general term denoting the area adjoining the outer edge of the roadway. Extensive areas between the roadways of a divided highwy may also be considered roadside.

Traffic Lane

The portion of the traveled way for the movement of a single line of vehicles.

Auxiliary Lane

The portion of the roadway adjoining the traveled way for parking, speed-change, or for other purposes supplementary to through traffic movement.

Parking Lane

An auxiliary lane primarily for the parking of vehicles.

Speed-change Lane

An auxiliary lane, including tapered areas, primarily for the acceleration or deceleration of vehicles entering or leaving the through traffic lanes.

Median Lane

A speed-change lane within the median to accommodate left-turning vehicles.

Outer Separation

The portion of an arterial highway between the traveled ways of a roadway for through traffic and a frontage street or road.

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SECTION NEWS

New York Section

The New York Section held its February meeting at the President's Tavern in New York City. The guest speaker was Edgar F. Copell, Traffic Engineer, Massachusetts Department of Public Works. Ed spoke on the traffic engineering organization and functions in the Department of Public Works in Massachusetts.

Following Copell's talk, there was considerable discussion concerning the O&D survey made in Boston and vicinity and the application of the facts obtained therefrom to future highway planning.

There were approximately 30 members and guests present.

Stanley T. Siegel

Washington Section

On December 14th, during the Highway Research Board meeting, eighty Section members and guests had the pleasure of hearing Charlie Noble present the highlights of New Jersey's plans for a toll road. Mr. Noble pointed out that the authorization for a toll road came as an alternative proposal due to lack of funds to build the necessary trunk highways to handle the tremendous traffic loads in New Jersey.

On Washington's birthday at the Fairfax Hotel the Section enjoyed an "armchair" trip to the Philippines. Mr. A. C. Taylor of the Bureau of Public Roads and Technical Director of the Regional Highway Planning Committee showed many splendid color pictures he had taken of life in the Philippines during the assignment on the post-war rehabilitation of highways and bridges throughout the islands.

William F. Boardman
Secretary

Western Section

The Southern California Area Group held its dinner meeting at the Rodger Young Auditorium on Tuesday, January 31st. There were 22 members and 59 guests in attendance. Hugo Winter was the principal speaker and gave a very interesting talk on "Design for Traffic".

Mr. Winter stressed the fact that adequate planning should precede the development of traffic facilities, and brought out the fact that cost of right-of-way, terrain features, and existing road systems were just as important in deciding the location of new traffic facilities as the location of the demand lines.

The discussion followed Mr. Winter's paper concerning principally a comparison of features in the older freeway developments and those now being constructed and projected for construction.

Reported by C. C. Clark

Secretary's Column

The Board of Direction held its regular quarterly meeting in Memphis, Tennessee, on March 5th, in connection with the Traffic Engineering sessions of the Southern Safety Conference reported elsewhere in this issue. There were six Board Members present, including President Smith, Vice-Presidents Cherniack and Neal, Secretary-Treasurer Osborne, and Directors Darrell and Porter.

The Secretary-Treasurer presented a report on the current financial status of the Institute which reflected a sound condition for the first five months' operation of the current fiscal year. Mr. Osborne reported that the Institute would undoubtedly operate on a balanced budget for the current fiscal year. The Executive Secretary reported that advertising contracts for "Traffic Engineering" magazine would adequately meet budgetary requirements. Written reports were received from the respective chairmen of the Annual Meeting Committees indicating that plans and preparations were progressing very satisfactorily for one of the most interesting meetings in the history of the Institute. Details were reported recently to ITE members through a special news letter.

The Board carefully reviewed its program of supporting regional and state-wide in-service Traffic Engineering Training Conferences. In view of the time-consuming activities and limited funds, the Board voted to withdraw from official and active participation in these conferences until such time as the resources of the Institute will permit.

Mr. Cherniack, Chairman of the Special Board Committee studying the move of ITE National Headquarters to a permanent location, submitted a report of progress on findings of the Committee to date. The Committee will obtain specific information on availability of office space in Washington, D. C., and when financial security is assured, that is, a net surplus above budgeted income can be realized in a sufficient amount to support a permanent headquarters, the move will be effected.

The Policy Committee reported unanimous approval of a change in present Affiliate member requirements to allow a more liberal interpretation and subsequent increase in membership. Changes in the appropriate portions of the Constitution and By-Laws will be presented to the Board at its June meeting and these changes presented to the entire membership prior to the time of the Annual Meeting. This change will also allow an increase in the number of Honorary members.

Nineteen new members and five transfers were approved at this meeting, increasing the total membership to 516.

Robert S. Holmes

LOOKING AHEAD

MAY 1-5, 1950—NEW ORLEANS, LOUISIANA
Third meeting of Inter-American Congress of Municipalities. Secretary, Obispo 351, Depto. 604, La Habana, Cuba.

MAY 2-4, 1950—CHICAGO, ILLINOIS
Twenty-seventh Annual Midwest Safety Show. Hotel Sherman. Contact Joseph F. Stech, manager, greater Chicago Safety Council, 10 North Clark Street, Chicago 2, Illinois.

MAY 24, 1950—CHICAGO, ILLINOIS
National Committee for Traffic Training. Special meeting. University Club, Chicago, Illinois.

MAY 25 & 26, 1950—CHICAGO, ILLINOIS
President's Highway Safety Conference. Meeting of Committee on Conference Reports. Hotel LaSalle.

JUNE 1 & 2, 1950—CORVALLIS, OREGON
Third Annual Northwest Traffic Engineering Conference. Oregon State College. Contact Martin Coopey, Associate Professor of Highway Engineering.

JUNE 18-21, 1950—BOISE, IDAHO
Western Safety Conference. Contact L. M. McKay, Vice-President, Western Safety Conference, P. O. Box 1038, Boise, Idaho.

New Appointments . . .

LLOYD M. BRAFF was recently appointed Traffic Engineer in Dallas, Texas, replacing William C. Brandes

who has left for more fertile fields, *March issue, "TE" magazine.* Prior to his new position, Lloyd was Assistant Chief, Traffic and Transportation Division, DeLeuw-Cather, Consulting Engineers, Chicago, Illinois. Since 1945, he has made traffic and transportation studies in more than twenty cities throughout the country, as well as Venezuela and Columbia. In 1942 to 1945, he was Director, Traffic Design Division of the Detroit Traffic Engineering Bureau. From 1936 to 1942, he was Student Engineer and Assistant Traffic Engineer at the Chicago Surface Lines.

CHARLES S. LECRAW JR. has accepted the position of Assistant Vice-President of Ramp Building Corporation, 230 Park Avenue, New York. Shortly after graduation from Georgia Tech, Charlie entered the Army, serving in various traffic and transportation jobs, including Traffic Officer, 30th Infantry Division; Instructor, Traffic Department, Military Police School; and Provost Marshall, 75th Infantry Division. In this latter assignment, he was shipped to Europe and served in three major campaigns. He now holds the rank of Lieutenant Colonel in the Transportation Corps Reserve.

Following the war, Charlie attended the Bureau of Highway Traffic at Yale University and subsequently became Resident Traffic Engineer of the Eno Foundation for Highway Traffic Control. In this position, he conducted research into various traffic and parking problems and was co-author of a number of publications and reports. During this period, Charlie also served as part-time instructor for special Army classes at the Bureau of Highway Traffic.

Charlie is an associate editor of "Traffic Engineering" and editor of the Institute's annual Proceedings. He also serves as Vice-President of the New England Section, ITE.

Otto Jelinek Elected President of Illinois ASCE

Otto K. Jelinek (Mem., ITE) was recently elected President of the Illinois Section of the American Society of Civil Engineers at the Annual Meeting of the Society.

Mr. Jelinek, an associate of Ralph H. Burke Company, Consulting Engineers, is well known throughout the State for his leadership in public projects and civic improvement programs for many years.

He was with the Chicago Park District from 1918 to 1946, serving as Traffic Engineer and Chief Planning Engineer during the development of the Park Improvement Program at a cost of $24,000,000. He was instrumental in developing Chicago's water front with such improvements as South Shore Drive, Burnham Park and Grant Park.

More Cities Regulate Commercial Parking Lots

An increasing number of cities are licensing and regulating operations of commercial parking lots, the American Public Works Association reports. Citing a recent survey, the Association pointed out that at least 59 cities of over 10,000 population now have ordinances to license or control parking lots.

Forty-five cities indicating that they had ordinances controlling parking lots required lot operators to obtain a city license. Nearly half of this group were large cities—those over 100,000 population. Nineteen cities required parking lots to have business licenses with no control exercised over operation or layout of the lot. Included in this group were Wilmington, Del., Jacksonville, Fla., Wichita, Kan., Flint, Mich., Seattle, Wash., and Milwaukee, Wis.

Some cities attempted to stabilize rates and prevent unwarranted changes in rates by parking lot operators. Eleven cities required operators to file a schedule of rates with their application for a license and these rates cannot be changed without approval. New York City has the most stringent regulations regarding change of parking rates, requiring a 60-day written notice be given.

Physical layout and maintenance of parking lots also receive attention in regulations of car-park areas. To prevent poor layouts, unsuitable surfacing and interference with sidewalk and street traffic, 34 cities set forth regulations on these matters.

Requirement most frequently found in city ordinances pertaining to parking lots was that a barrier be provided between the parking lot and adjoining properties. Twenty-three cities require barriers. Eight cities regulated the number of entrances and exits at the lots.

Few cities' regulations pertain to financial responsibility of parking lot operators. Five of the cities furnishing information required operators to post bond or carry insurance covering the lots against claims for which it is found liable by the courts. Los Angeles, Denver and Jackson, Mich., required proof of bond or insurance be-

(See MORE CITIES, *page 290)*

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Personalities . . .

DONALD S. BERRY was born at Vale, South Dakota, on January 1, 1911. He is reticent to provide any details of his early existence in South Dakota but we do know that he attended the South Dakota School of Mines and graduated in 1931 with a B. S. in Civil Engineering.

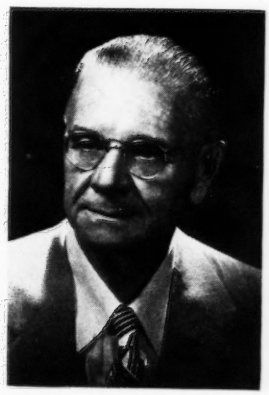
Don states that he graduated in the middle of a depression when jobs were really scarce. After a summer as Chief of Party on a survey crew for the Highway Department in South Dakota, he went to Iowa State College as a graduate assistant in the Department of Civil Engineering. While at Iowa State, he worked with Professor Moyer on the research on skidding of vehicles on road surfaces.

He obtained his Master's degree in Highway Engineering at Iowa State in 1933. Since jobs were still hard to get, he "wrangled" a fellowship from Professor Roger Morrison and finally emerged from the University of Michigan with a Ph.D. in Civil Engineering-Transportation, in 1936. During his struggle for a "doctorate", he was assigned to the Michigan Highway Department as a laboratory research assistant engaged in research studies in highway engineering.

Don accepted a position as Traffic Engineer for the National Safety Council in March 1936 and, with the exception of an occasional "leave of absence", worked with the Council continuously until September 1947. In May 1943, his title was changed to Director of Traffic and Transportation Division. His experience with the Council was quite varied and included consultation service to cities as well as preparation of reports on speed con-

(See BERRY, *page 290)*

CARROLL CARSON WILEY, most commonly known as "CC" or "C²", was born in Christian County, Illinois. His father was a Methodist minister so he had a certain reputation to maintain as a youngster. Out of this, however, came some experiences and possibly traits of use to either a professor or a



Traffic Engineer.

His early schooling was a *hodge-podge* performance as the family hopscotched from small town to small town about every two years. He finally hoodwinked the University of Illinois into admitting him and later into granting him the degree of B. S. in Civil Engineering in 1904. In 1910, after joining the staff, he was "promoted" to Civil Engineer.

Following graduation, "CC" spent a little over two years out in the cold cruel world, mostly on railway frogs and crossings at Cincinnati and Johnstown, but with a flier at steel detailing in Chicago. Not being intrigued by a life spent in punching holes in hunks of iron and plugging them up with rivets, and at the same time having ideas of matrimony in which neither party desired to live in the "Windy City", he accepted a job as instructor in Civil Engineering at the University of Illinois in 1906. Although he had been there forty-three years he hasn't learned enough to get away.

His first teaching was surveying, where, partially because of earlier work on railroad track specials, he developed "pet peeves" with respect to curvature, super-elevation, and the use of spirals. He still thinks we could make vast improvements in our highways with respect to these if we would start using our heads instead of a flock of antedeluvian tables.

About 1908, "CC" began to understudy the late Professor Ira O. Baker, one of the earliest and best highway teachers. Subsequently, he took over the highway courses when Professor Baker retired a few years later. The first *advanced* highway course was given in the Spring of 1914. Since then highways and traffic have been his "pets".

"CC" doesn't know just when he first became interested in traffic. He claims he was born with it. He remembers watching the old horse-drawn traffic and the traffic cops in the Chicago loop at the time of the World's Fair of 1893. He has literally "grown up" with modern road building and traffic in Illinois. He recalls discussing matters that now would be termed *traffic engineering* with the late A. N. Johnson as early as 1913.

He became a Member of ITE in 1937. He is also a member of ASCE, ISPE, SAME, ASEE, ARBA and Sigma Xi. He says it doesn't make any difference whether you know what all of these are because he's a member anyway. "CC" is a Methodist and a Registered Professional Engineer in Illinois.

Dissatisfied with the ordinary field manual as a textbook in railroad surveying, the late Professor G. W. Pickels and "CC" got out a "Textbook on Railroad Surveying" in 1913. Sixteen years later, they enlarged it into "Route Surveying", giving especial consideration to *highways*. Ten years later, in 1939, a second edition appeared and, again, 10 years later, 1949, despite the death of Professor Pickels in 1944, the third edition appeared.

Not profiting by the above experience as an author "CC" released "Principles of Highway Engineering" in 1929 with a second edition in 1935. The third edition is now *boiling*, which accounts for the increased consumption of bromo-seltzer. He states that articles, reports, circulars, bulletins, ad infinitum, make his writing prolific, even if not profound.

"CC" has three sons to brag about. The eldest, "Teke", and youngest, "Tom", are both on the ITE roster. This may be some sort of a *record!* The second son, Lockwood, rather abhorred engineering so is a librarian in a big high school with strong predelections for dramatics and singing. His wife, in addition to making home really home, keeps on the jump with radio, PTA, church, clubs, etc. For

over 14 years she has been director of a weekly parent-teacher program on the University's radio station, W-I-L-L. He claims that their home has been a perpetual madhouse ever since "Teke" started to school with *picking goat feathers* as the principal activity.

He states that if he has any hobbies he doesn't know it. Maybe this is because of a theory that whenever an avocation requires constant attention it ceases to be a sport and becomes a job. He rarely goes fishing as it always turns out that there is altogether too much water for the number of fish. He says that he finds more hunting than he wants right in his office. He dislikes *structural* engineering so much that he doesn't even play bridge. He tried golf but gave it up when "Teke", at 15, started beating him. He likes to tinker with his car when he is tired because it can't talk back when he calls it things for being beset with what Kipling called "the perversity of inanimate things". Apparently he does favor photography. He likes to get sharp definite and full detail instead of these hazy, out-of-focus, artistic effects. He carries a simple, but very effective and comparatively inexpensive outfit in an M-1 ammunition box, along with a small first-aid kit for use in case he actually "shoots" himself.

"CC" has a few years to go and states that he will rate "Emeritus". What will he do then? He doesn't know. He never did believe in making plans on inadequate and incomplete data. Only one thing is certain—he will *not* move to Southern California as he has often wondered why we ever took that area away from the Mexicans.

BERRY

(Continued from page 288)

trol, vehicular inspection, tests for intoxication and other technical subjects.

In 1942 and 1943, Don was given a "leave of absence" by the Council to work, first, with the FBI as a special employee agent conducting training schools on emergency traffic control plans; and, second, as Sr. Traffic Engineer for the U. S. office of Civilian Defense, working with states on the preparation of emergency traffic control plans for air raids and evacuations. In September 1948, "Dr." Berry accepted appointment as Assistant Director for the Institute of Transportation and Traffic Engineering of the University of California at Berkeley. His duties included teaching graduate and under-graduate courses in traffic engineering; guidance in traffic training, institutes, and other in-service training activities, and conduct of traffic research. He is a member of the Executive Committee of the Institute of Transportation and Traffic Engineering and visiting Professor of Transportation Engineering on a three-year basis.

Don has been an active member of the ITE since election to membership in 1936. He assisted in the preparation of one chapter of the first edition of the "Traffic Engineering Handbook" and was one of a selected group of traffic engineers to review the final draft of the revised edition. He has also been active for several years on the Institute's committee on Traffic Engineering Curricula and Education. In addition to his affiliation with ITE, Don is a member of the Society of Automotive Engineers, the American Society of Civil Engineers and a registered professional engineer in Michigan.

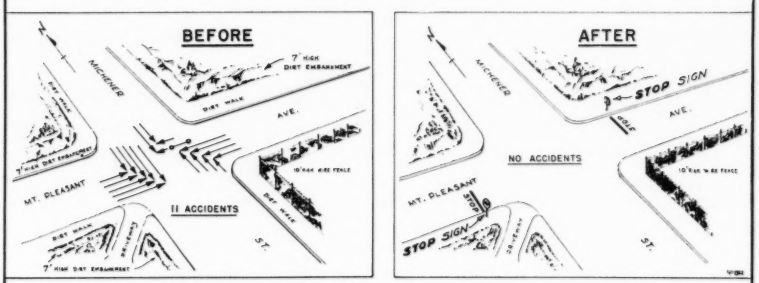
We have no clue as to Don's hobbies; however, the *grapevine* states that he can handle himself with flying colors against the best opposition on the golf course. Perhaps that is the reason for his "trek" to California so that he could devote more time to his favorite sport.

GETTING RESULTS THROUGH TRAFFIC ENGINEERING

No. 8

TRAFFIC SITUATION No. 8
STOP SIGNS PREVENT ACCIDENTS

PROBLEM—Traffic accidents increased out of all proportion at the intersection of Mt. Pleasant Avenue and Michener Street, Philadelphia, during 1938. As shown on sketch, the intersection is a right-angled one, bordered on three corners by vacant lots with seven foot high embankments.



ACCIDENT FACTS—Prior to the installation of STOP signs on Mt. Pleasant Avenue on July 2, 1938, there were three accidents in 1936, one in 1937, and eleven in 1938. No pedestrians were involved in the accidents, and, as shown in the collision diagram, all of the accidents were right-angle collisions occurring in late afternoon or at night.

FIELD STUDIES—A volume count showed approximately 3,000 vehicles using the intersection on an average day, each street carrying about 50%. Visibility was rather poor due to high embankments on three corners and a wire fence on the fourth.

SOLUTION—The stopping of traffic on one street in favor of that on the other was found to be the solution after a careful study of all factors involved. STOP signs were erected stopping the traffic on Mt. Pleasant Avenue. The cost of this improvement was negligible.

CHECK BACK—In twelve months since the installation of STOP signs no accident was reported.

This is the sixth in a continuing series of exact reproductions of selected "Getting Results" examples, published through the courtesy of the Accident Prevention Department, Association of Casualty & Surety Companies. These early examples were contributed and originally published prior to World War II. We prefer to retain the contributor's title and address as it existed at the time the example was submitted.

Example contributed by
Robert A. Mitchell
Traffic Engineer and
Acting Assistant Director,
Department of Public Safety
Philadelphia, Pennsylvania,
Member, Institute of Traffic Engineers.

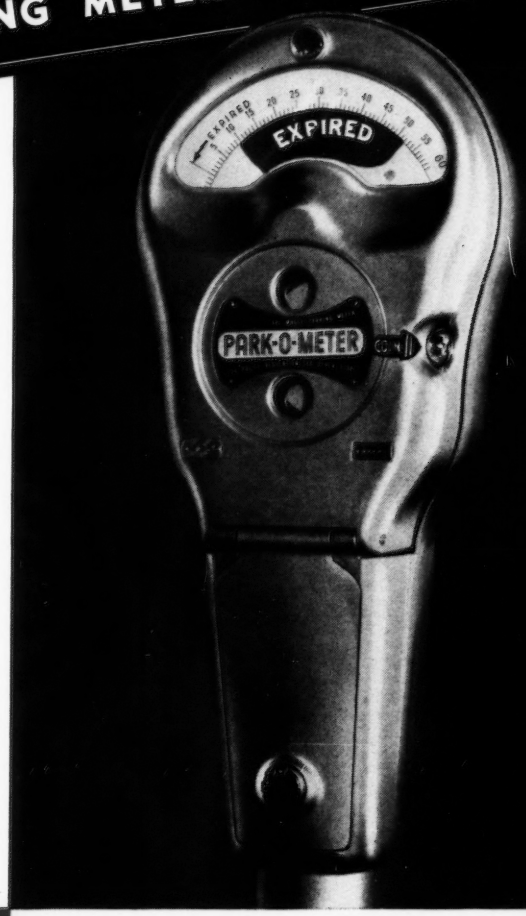
MORE CITIES

(Continued from page 287)

fore a license is issued. Philadelphia and Milwaukee required a bond of $2,000 when a license is renewed, if in the previous period of licensing the operator failed to satisfy all judgments against him. Eight cities had ordinances pertaining to fire apparatus and protective devices at parking lots.

The Municipality

ONLY PARK-O-METER MEETS EVERY REQUIREMENT OF A MODERN PARKING METER SYSTEM



Your parking meter system should give you:

1. PUBLIC ACCEPTANCE. The public *must accept and use* the system if it is to succeed. Here Park-O-Meter's easy-to-use, one-hand, automatic operation wins out. In competitive installations with other makes *Park-O-Meter is always the public's choice!*

2. INCREASED TURN-OVER. The object of any metered parking system is to make more parking space available to more people. Repeated surveys prove that Park-O-Meters *do get faster turn-over at the curb.*

3. REDUCED ENFORCEMENT COSTS. Park-O-Meter's big "see through" signal housing and large Signal Flag make enforcement *easy and fast.* Your traffic patrolman can read meters on both sides as he makes one trip down the street.

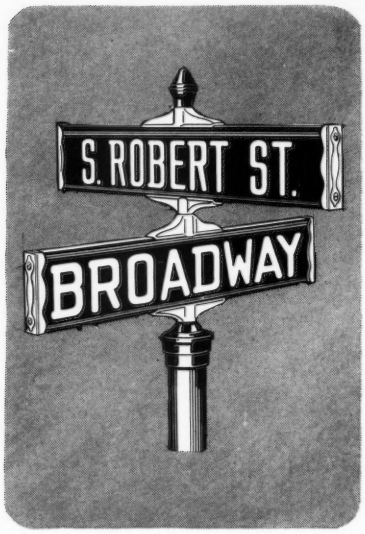
4. INCREASED REVENUE. In comparative tests all over the nation PARK-O-METERS show *higher net revenues* than other makes. Among factors contributing to this are: Trouble-free operation; the PARK-O-METER slug detector; the Out-of-Service Flag, and the fact that Park-O-Meter gives time only in return for a coin.

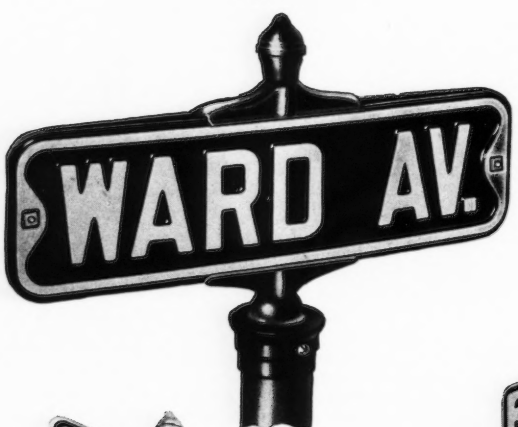
5. ADAPTABILITY. Any meter system must be adaptable to changing conditions. PARK-O-METER is *instantly convertible* for either cumulative or non-cumulative time; provides for any coin-time combinations: 6, 10 or 12 minutes to 2 hours, using single or multiple pennies or nickles. Conversions can be made on the site . . . nothing to replace . . . no new parts . . . no loss of service.

6. MINIMUM SERVICE MEANS MORE NET REVENUE. Comparative tests prove that Park-O-Meter's receipts show a larger percentage to NET REVENUES than those of competing makes. Park-O-Meters are sturdily constructed, dirt and weather proof, not subject to pilfering nor tampering. All mechanical parts are assembled in demountable, quick replaceable units for easy on-the-job replacement so that meters need not be out of service. These all contribute to NET.

ASK US FOR PROOF THAT PARK-O-METER DOES GIVE YOU A COMPLETE, *Modern* SYSTEM

Your streets have names... identify them proudly





MODERN STREET NAME SIGNS by LYLE

●The identification of streets and boulevards, with beautiful, legible signs, is an essential civic improvement. Street name signs dress up a town . . . they're the finishing touches of good grooming and quiet self-respect.

For over 35 years Lyle has been serving American communities with street name signs . . . and we emphasize these years of service because, once a community has selected a design style, it wants assurance that its sign supplier will be in business years hence to furnish the same type and style of sign to identify community expansion or the changing of street names.

Lyle offers two types of signs . . . Lyle Deep-Embossed and Lyle Carved-in-Metal letters . . . plus a complete line of posts, brackets and accessories. Write today for special street sign catalog . . . or, if you'd like to examine a sample of any Lyle signs illustrated, we'll be glad to send it . . . without cost or obligation, of course.

LYLE SIGNS, INC.
2720 University Ave. S. E.
MINNEAPOLIS, MINNESOTA

POSITIONS AVAILABLE

The City Civil Service Commission, Nashville, Tennessee, 305 City Hall will hold an Entrance Examination for the position(s) of

TRAFFIC ANALYST I
TRAFFIC ANALYST II

TIME AND PLACE: Applicants will be properly notified of the time and place of each section of the examination.

SALARY: $275.00 to $325.00 per month, as tentatively provided by the present pay plan for Traffic Analyst I. $325.00 to $400.00 per month similarly provided for Traffic Analyst II. Salary is subject to a five (5%) per cent deduction for pension purposes.

APPLICATION INSTRUCTIONS: Application blanks will be sent upon request by writing to Civil Service Commission, 305 City Hall, Nashville 3, Tennessee. Applications returned by mail must be postmarked before Wednesday, May 31, 1950.

DUTIES OF POSITION: Responsible survey, advisory and supervisory work in the solution of street traffic problems. Research investigation and analysis of speed, congestion, accident incidence and location, traffic signs and signals and critical study of traffic data from other municipalities. Related work as may be required.

MINIMUM QUALIFICATIONS: Applicants must be between the ages of twenty-one (21) and forty (40), inclusive, at the time of the deadline for accepting applications. Graduation from an accredited engineering college or university is requisite for Traffic Analyst I. For Traffic Analyst II, post graduate training and/or appropriate professional experience.

VETERANS REFERENCE: Veterans of the armed forces of either World War I or World War II may have 5 points added to their earned rating by submitting a copy of their discharge papers to the office of the Civil Service Commission on, or before, the closing date for receiving applications.

Junior Traffic Engineer
Dallas, Texas

SALARY: $250-$315 per month.

VACANCY: Traffic Engineering Division.

REQUIREMENTS: Degree in engineering—civil, electrical or mechanical—plus two years' experience in traffic engineering work; one year of experience may be substituted for one year of college up to a maximum of two years. One year of experience may be substituted for completion of a recognized traffic control course.

APPLY: Civil Service Board, 412 City Hall, Dallas, Texas.

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A DURABLE PLASTIC REPLACING PAINT ON PAVEMENTS

1. Widely used by leading cities for over 14 years.
2. Its use cuts marking costs by over 50 per cent.
3. Very high reflection and visibility.
4. Easy to apply. We train your own crews.
5. Installed with no interference with traffic.
6. Ideal for new and resurfaced pavements.
7. Available in desired sizes and colors.

NEW — An Industrial Marker — perfect for marking off-street parking lots and garages.

Let us supply you with full information.

ARMOR-FLEX COMPANY
St. Louis 22, Mo.

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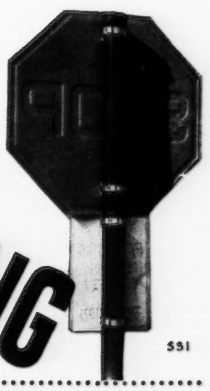

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THE MODERN WAY TO ATTACH STREET SIGNS and HIGHWAY MARKERS

For permanent installations we recommend Stainless Steel Strap and Galvanized Steel for semi-permanent applications. Complete accessories available in both metals.

FREE DEMONSTRATION—

Without cost or obligation, we will demonstrate the A. J. Gerrard Improved Way to secure a sign.

Write for name of nearest representative.

A. J. Gerrard & Co.

1954 Hawthorne Drive . Melrose Park, Ill.
(Chicago Suburb)

YOU CAN BE SURE OF QUALITY WHEN YOU BUY . . .

THE GENUINE
MIRO-FLEX
STREET NAME
ASSEMBLIES

No doubt about it! Quality is apparent from first inspection. Letters are deep embossed on 18-ga. galvanized, bonderized steel. Contrasting baked enamel colors for letters and border. Very rigid.

Miro-Flex street name assemblies are in demand the country over. They are made for all conventional street marking — two-way or four-way in pole top or bracket type. Write for complete catalog of standard signs for marking highways or streets and traffic control signs.

4-50

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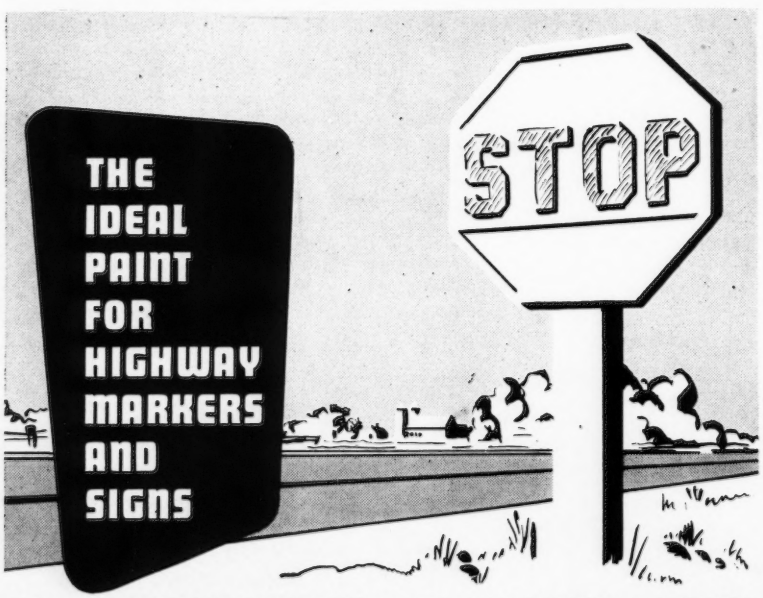
MIRO-FLEX CO., INC.
1824 EAST SECOND STREET · WICHITA, KANSAS



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These brighter colors make your message stand out. Fine gloss finish further increases visibility.

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Dries with a hard, tough surface that lasts indefinitely in all climates.

LOW COST

Covers 900 to 1200 sq. ft. Works faster, goes further.

NAZ-DAR WEATHERPROOF SILK SCREEN ENAMEL

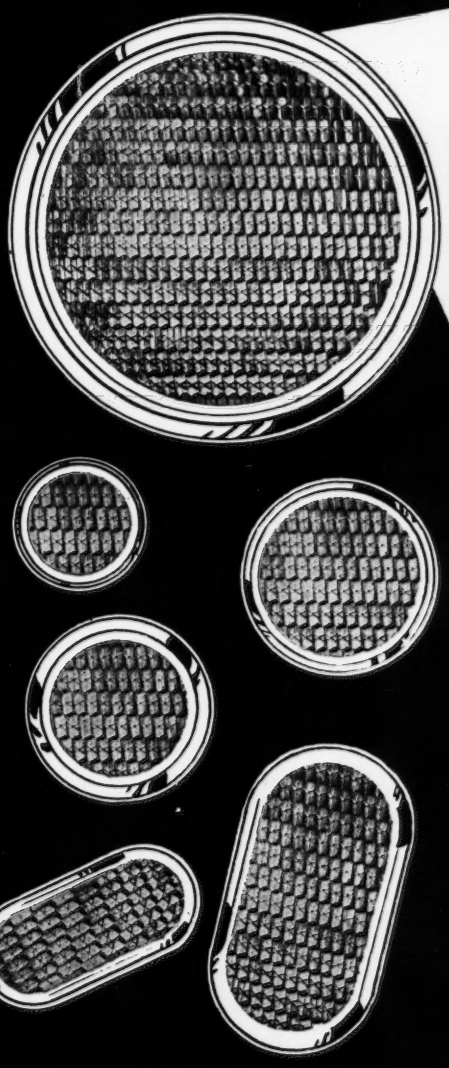
Make Naz-Dar your headquarters for ALL silk screen supplies. Color, silk, squeegees, stencil knives, everything you need for bright, long-lasting signs. *Write for further information.*

TE 4-50

Naz-Dar Company
469 Milwaukee Ave.
Chicago 10, Illinois

Sign up for

WITH...



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Grotelite PRISMATIC REFLECTORS

Now brighter—more dependable than ever before, Grotelite Prismatic Reflectors are the most effective reflectors for all caution and warning signs. Sealed to protect against dirt and moisture, Grotelite Prismatic Reflectors are brighter—clearly visible at greater range—safer, because they reflect the warning message—impel obedience to the authority of all traffic signs. Grotelite reflectorized signs are the kind that make motorists STOP — LOOK — and LIVE.

FOR FAR-SIGHTED ECONOMY, USE SAFETY-WISE GROTELITE REFLECTORS

Use economical Grotelite Prismatics for signs made in your state or municipal sign shop. Write for details and new low prices.

Grote

The GROTE MFG. CO., INC.

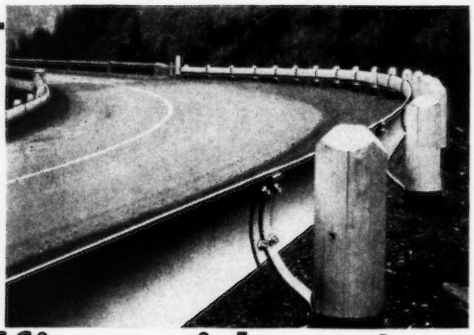
GROTE SQUARE, BELLEVUE, KY.

Opposite Cincinnati

A GROTE REFLECTORIZED SIGN IS THE BRIGHTEST MESSAGE ON THE ROAD

Exceeds all state safety specifications

TUTHILL HYWAY GUARD



cuts traffic accidents!

Write for technical brochure today!

Super-strong Hyway Guards safely deflect cars and cushion shock to vehicle, occupants and rail. Easily seen by day or night. Speedy, permanent erection with little or no maintenance required.

TUTHILL SPRING CO.
760 W. Polk Street, Chicago 7, Illinois

YOURS FOR THE ASKING.....

A NEW GRANITE CURB FOLDER 7T—Containing complete specifications on fabrication and setting of Standardized Granite Curb, also detail drawing of high speed highway entrances and exits. Every traffic engineer should have it.—Write for your free copy today.

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DOUBLE DUTY...

DOUBLE BEAUTY

AT A SAVING!

City Hall, Vancouver, B. C.

...with Monotube Steel Poles

ONE look at the street scene pictured above shows you how *much* Monotube steel poles do. And how beautifully they do it!

These rugged poles support miles of trolley span wires for Vancouver's extensive trolley coach system. That's just part of their duties. They also carry the city's street lighting system—eliminating the unsightly clutter of several sets or types of poles. Streets are more attractive, day *and* night. Important, too—by reducing the number of poles needed, Monotubes make substantial savings on equipment costs.

Over 3,000 Monotube poles are already serving in Vancouver's utility modernization program. The majority are made of single ply 7 gauge steel. At locations where extra strength is required, 3 gauge and 0 gauge poles in single and double ply are used. Poles are 10″ and 12″ in diameter at the base and 30′ long.

Monotube tapered steel poles are strong, durable, attractively designed—built to meet varying strength requirements. They're ideal for many utility services . . . economical, too. For complete information, write The Union Metal Manufacturing Company, Canton 5, Ohio.

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Monotube Street Lighting Standards

Fast... Accurate... Economical

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"SUPER 4" MARKER

Speeds Up Street Striping — Self-Propelled

At speeds up to 5 miles an hour, this M-B "Super 4" Marker lays down clearly defined lines — single or double, straight or curved, in any color. Select speed for each type material with variable speed drive. Simple to use — no skilled operator needed. "Mistless" for economical paint gallonage per mile. Easily converted to all-purpose sprayer. Optional equipment includes single or double line reflective bead dispenser.

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MEILI-BLUMBERG CORPORATION

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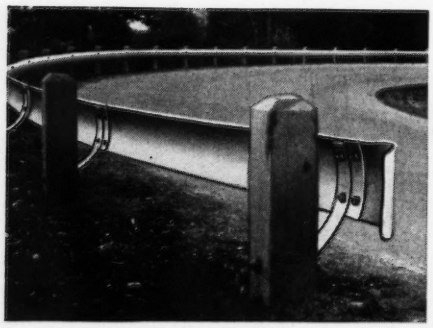

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Maximum VISIBILITY
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